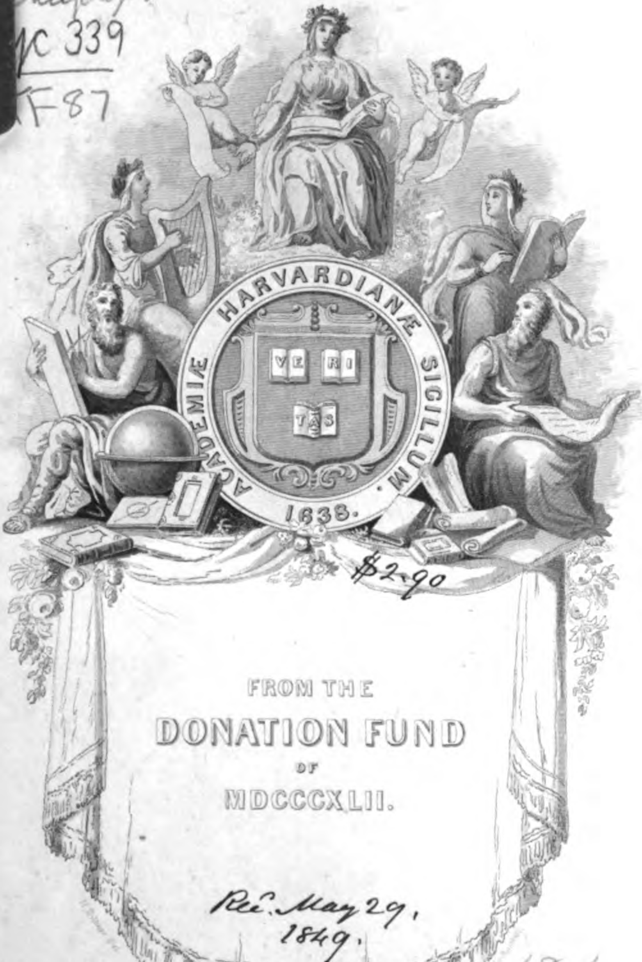
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FROM THE
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Drawn by J. Holmes from a bust by P. Bonnardi

Engraved by T. Landseer

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Published as the Act directs by Darton & Clark 1841

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A

MILLION OF FACTS,

OF

CORRECT DATA,

AND

Elementary Constants,

IN THE

ENTIRE CIRCLE OF THE SCIENCES,

AND ON ALL SUBJECTS OF

SPECULATION AND PRACTICE.

BY SIR RICHARD PHILLIPS.

What should one read for?—For!—Why to know *Facts*.—*Pope*.

The man who writes, speaks, or meditates, without being well stocked with *Facts*, as landmarks to his understanding, is like a mariner who sails along a treacherous coast without a pilot, or one who adventures in the wide ocean, without either rudder or compass.—*Bacon*.

Facts are to the mind the same thing as food to the body. On the due digestion of facts depend the strength and wisdom of the one, just as vigour and health depend on the other. The wisest in council, the ablest in debate, and the most agreeable companion in the commerce of human life, is that man who has assimilated to his understanding the greatest number of facts.—*Burke*.

Within the last two hundred years, or since Galileo and Bacon taught us this great lesson, we have been employed in recording *Facts* in ten thousand several Volumes. But, thus scattered, they lose so much of their value and importance, that, in another age, we may hope some aspirant after literary glory will perform the Herculean labour of condensing the whole into a volume.—*Playfair*.

STEREOTYPED EDITION,

MUCH ENLARGED, AND CAREFULLY REVISED AND IMPROVED,

WITH A PORTRAIT OF THE AUTHOR.

London:

PUBLISHED BY DARTON & Co., 58, HOLBORN HILL.

AND TO BE HAD OF ALL BOOKSELLERS.

1848.

1849 May 29

Lincoln Fund £ 2 9 0

PREFACE

TO THE STEREOTYPED EDITION.

ANOTHER and another edition of this Volume is called for, and one edition is scarcely published, before the Editor finds himself in requisition to prepare a new one. The result is highly advantageous to purchasers, since current corrections confer on the work the utility of a Calendar of Science and Knowledge; a feature which could not have been anticipated when the work was planned. Five very large Editions, in seven years, of a volume of its size and price, and an increasing, rather than slackened demand, are stimulants to the Author's attention, which he flatters himself will be visible in every page of the present Stereotyped Edition.

The great success of the Work, and the burst of applause which followed its publication, have encouraged him to bestow unremitting labour in conferring every practical perfection on this Edition. New Chapters have been added, others have been re-composed, and every column, almost every paragraph, has undergone revision. At the same time, a faultless work, embracing so extensive a range of subjects, amidst so many conflicting authorities, cannot be expected; while no labour to reconcile contradictions, and no care to exclude mistakes in typography, have been spared in a work which has no likeness in quantity, compression, and variety.

If the First Edition might be honestly called A MILLION of Facts, this might now, with strict propriety, be called A MILLION and a HALF; for the additions have been immense, while repetitions have been avoided, and a more perspicacious display of the matter, and a more analogous juxtaposition of the subjects have, in general, been effected.

Such a work, from its nature, can however be only an approximation towards perfection; since facts, or results, are so numerous, that even a Billion, if desirable, would not include all. The utmost, therefore, that can be expected, is a selection of the more important and interesting to serve as Data in reasoning, action, or contemplation.

It may, however, be necessary for the Author to guard himself against a mistaken notion, that this Volume is a servile collection of

scraps and common-places. Every erudite reader will correct this mistake, and perceive that the Author speaks for himself in every column, and almost in every paragraph. Little, in fact, has been taken on trust on any subject; and the harmonizing of discordances and discrepancies has been a labour far exceeding belief.

The variety of subjects, and the complication of details relative to some of them, unavoidably expose the work to criticism from those who have devoted their lives to single subjects, and the work may sometimes be found in error, when judged by such accurate critics; yet, it may be hoped, that in most cases it will appear that the Author has seized on the prominent points, and has given place to tables, figures, quantities, ratios, and constants, whose exhibition, in this form, will at least be found convenient.

By students in general, and literary men in every pursuit,—by persons residing at a distance from large libraries,—by those who wish to avoid the labour of research and comparison,—by practical men,—by politicians,—and even by the readers of newspapers and journals,—by residents in distant climes, and by travellers, to whom large books are an incumbrance,—by loungers at watering-places, and by summer-residents at country-seats, the volume will, he trusts, be deemed a valuable acquisition. In a word, he conceives that, even in the largest libraries, in colleges, schools, and universities, regarded only as a portable index of ready reference, it will extort approbation.

In this form, he has been enabled to present to the world above a hundred thousand facts, at the low price of one shilling, or about nine thousand for a penny. Much has been vaunted about cheap publications, and penny magazines have been the wonder of the day; yet, in comparison, the present is the most memorable example, for nothing else in literature or in printing can compete with 9000 FACTS FOR A PENNY.

Facts, too, have special value: they are the data of all just reasoning, and the primary elements of all real knowledge. The wisest man is he who possesses the greatest store of Facts within the command of his understanding. A book, therefore, which assembles Facts from all their scattered sources, may be considered as a useful and important auxiliary to Wisdom. It lays claim to be the companion of ALL who earnestly seek truth at the fountain-head; of ALL who think for themselves, or would be thought to do so; and of ALL who desire to correct errors in themselves or in others.

The Author, in applying to current knowledge *the test of Facts*, and often in examining previous determinations, and the connection of premises with generally-admitted conclusions, has unambitiously detected many errors in received systems. He might have consulted his ease, by yielding to admitted authorities and existing predilections; but his respect for truth, and for his readers, and a just regard of his own reputation, have forced him to impeach some doctrines that are at variance with fact and right reason. In not servilely compromising the truth, he is persuaded he shall obtain the suffrages of most of his readers, and time will, doubtless, remove the tenacious prejudices of others. The life of Galileo is a warning to Authors who prefer what is *true* to what is *agreeable;* but the moral courage of Fontenelle is not to be admired for declaring that "*if his hand were full of truths he would not open it.*" It may be both wise and prudent not "to run a tilt" at all the cherished errors of the world; but no man ought to write and publish that which he knows to be not true, nor falsify evidence to please any faction in science or politics.

The Author is *unclanned and unclubbed*, and by him truth has not been qualified to please a party, nor modified by any sinister influence.

He has endeavoured to make his book as like the Elements of Euclid as its peculiar nature would permit, and as is consistent with good taste in its composition. His object has been, with singleness of purpose, to exhibit, *truly*, all those features of study and inquiry, which distinguish an enlightened epoch of an intellectual nation; and it has been his ambition, not only to make a true reflection of the pursuits of such a people, but to become, also, the harbinger of further improvements. In the march of intellect which characterizes the age, it behoved the Author of such a volume to be in advance, rather than in the rear. His advocacy, when it is displayed, will, he is persuaded, be always found to be on the side of human happiness, general benevolence, and scientific truth. He was aware, also, that a Million of Facts would be like a million of bricks in the kiln of the maker, if some interest were not conferred on them, by cementing and arranging them with the *sentiment* that belongs to approved architecture.

His pretensions for such a task are a prolonged and uninterrupted intercourse with books and men of letters. He has, for forty-nine

years, been occupied as the literary conductor of various public journals of reputation; he has superintended the press in the printing of many hundred books, in every branch of human pursuit; and he has been intimately associated with men, celebrated for their attainments in each of them.

It will be found, when the same data appear to be repeated, that it is in some new combination, and that the repetition has been made for greater precision.

Authorities are not often named, because there is not room for literal quotation, and the facts are generally applied in original relations. In general, too, every fact is verified by those combinations, while, in nine cases out of ten, the Editor has renewed calculations and corrected erroneous results, which for a century have been copied without examination. The erudite alone can do justice to much labour, which does not appear on the face of many paragraphs. Many writers enjoy renown for single determinations, while, at least, ten thousand, in this volume, are inserted by the Author, without ostentation.

As all parts are expressed in decimal fractions, or in 10th, 100th, 1000th, &c. parts, the reader should understand that the fraction follows a full point; that the first figure after the point is 10ths, as ·5 or 7, that is, 5-tenths, or 7-tenths. The second figure is *hundredths*, as ·03 or ·05 is 3-hundredths or 5-hundredths, while 75 is 75-hundredths, and 25 is 25-hundredths. The entire practice of decimals may, however, be learnt in two hours, by means of a little shilling book, "BLAIR'S FIRST LINES."

A rational theory of the atomic mechanism of Gassification, another of Heat, a third of the cause of all Electrical Phenomena, a fourth of the true cause of Weight and Central Force; the recognition of the Claims of the Geologists to a great age of the world; a Chapter on Railroads, and five or six others, render this work different from mere compilations from Cyclopædias of the last age, and bring down all the details of Science to the improved state of knowledge at the commencement of the year 1840. Without great care and Herculean labour on these points, the work would have been unworthy of consultation, and of the ambition of the Editor.

London, December, 1839.

ANALYTICAL, OR PROSPECTIVE

INDEX,

Serving the Purposes of A FINDER *in an Astronomical Telescope, in relation to the Contents and the Alphabetical Index at the End of the Volume.*

A FINDER *has hitherto been a Desideratum in this Volume, since a* MILLION OF FACTS, *like a Million of Stars, require distinct Vision to discriminate Standard Points amid the blaze of the Galaxy.*

I. ENGLISH MEASURES AND WEIGHTS.

II. FRENCH MEASURES AND WEIGHTS.

III. MEASURES OF CAPACITIES.

IV. WEIGHTS, OR CENTRAL FORCE.

V. MEASURES OF LENGTH.

VI. ENGLISH AND FRENCH SYSTEMS,

VII. MONEY AND COINAGE.

VIII. MEASURES OF TIME AND CHRONOLOGY.

IX. HISTORICAL CHRONOLOGY.

XXI. INSECTS.

XXII. ZOOPHYTES & INFUSORIA.

XXIII. VEGETATION, OR BOTANY.

XXIV. THE MINERAL KINGDOM

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XXV. GEOLOGY.

XXVI. HYDROLOGY.

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XXIX. CHEMISTRY.

XXX. HEAT.

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LIGHT, AND ITS PHENOMENA.

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L. FRANCE.

LI. AMERICA.

LV. BRITISH CONSTITUTION AND LAWS.

LVI. NAVAL AND MILITARY.

LVII. THE ANCIENT MYTHOLOGY.

LVIII. ANCIENT HISTORY.

LVIII. BIOGRAPHY.

LIX. THEOLOGICAL STATISTICS.

END OF ANALYTICAL INDEX.

THE MILLION, &c.

THE

MILLION OF FACTS.

*** *Persons unused to Decimal expressions, may become familiar with them in half an-hour, by consulting* Blair's First Lines of Arithmetic, *sold at* 1s. *It may, however, be stated briefly, that the first figure to the right of the point is always* tenths, *the second figure from the point is* hundredths, *the third is* thousandths, *&c. Thus* 3·5, *is* 3 *units and* 5 *tenths;* 7·24, *is* 7 *units and* 24 *hundredths; or* 5·308, *is* 5 *units and* 308 *thousandths. No arithmetical expression can be accurate without the Decimal Notation.*

The characters used are = *for equal,* + *for addition,* — *for subtraction,* × *for multiplication,* ÷ *for division, as* $8 \div 2 = 4$, *or* $\frac{8}{2} = 4$; 3^2 *for the square of* 3, *and* 3^3 *for the cube of* 3; √ *or* $\frac{1}{2}$ *the square-root, or* ∛ *or* $\frac{1}{3}$ *the cube-root.*

THE ENGLISH SYSTEM OF MEASURES AND WEIGHTS.

The law for regulating the Weights and Measures in Great Britain, was passed June 17, 1824. It declared the standard of *measures* to be the vibration of a seconds pendulum, 39·1393 inches; the standard of *weights* to be 252·458 grains, (the weight of a cubic inch of distilled water, at 62° and bar. 30;) and the standard gallon of *liquid* measure to be the cube which weighs 10 pounds of water, at 62° Fahrenheit and 30 bar., which cube is 277·274 cubic inches. Also 2218·192 cubic inches, or 80 pounds for the imperial bushel of 8 gallons.

These are the bases, and a foot is 12 such inches, an avoirdupois pound 7000 such grains, and a cubic foot of 1728 cubic inches is 62·3206 pounds, or an ounce of water 1·73298 cubic inch.

All divisions and names of measures to remain as before the new Act, but the quantities to be taken as above.

Under this Act, to convert *old* corn measures into the *new* ones, multiply by 0·96943, or by $\frac{31}{32}$. *New* into *old* by 1·03153, or by $\frac{32}{31}$.

To convert *old* wine measures into *new*, multiply by 0·83311, or by $\frac{5}{6}$. *New* into *old* by 1·20032, or by $\frac{6}{5}$.

To convert *old* beer measures into *new*, multiply by 1·01704, or $\frac{60}{59}$. *New* into *old* by 0·98324, or by [illegible].

When the cubic inches are given, divide for gallons by 277·274.

We have fixed denominations of Lengths, Superficies, Solidities, Weights, and Times.

Lengths are inches of 12 to a foot, and 36 to a yard; 220 yards to a furlong, and 1760 yards to a mile, of which, there are $69\frac{1}{12}$ in a degree, and 360 round the Earth, or in about 24,870 miles. There are, also, 5280 feet, or 63,360 inches in a mile.

Superfices are multiples of two dimensions, length and breadth, thus 12 × 12 are 144 square inches in a foot; 9 square feet in a yard, and 4840 square yards, or 43,560 square feet in an acre. Also 640 square acres in a mile.

In *Solidity* of three dimensions, length, breadth, and thickness, we have 27 cubic feet (3 × 3 × 3) in a cubic yard; and 1728 cubic inches in a cubic foot. Also 8·6648 cubic inches in a gill; 34·65923 in a pint; 69·31846 in a quart; 277·2738436 in a gallon; by 36 in a barrel 9981·658; by 8 for a bushel, or 2218·19074856; and this by 8 for a quarter.

Weight, fall of bodies, or central force in the diagonal of the Earth's motions, is estimated in grains, of which 7000 are an avoirdupois pound, and 5760 a troy, or apothecaries pound. The avoirdupois is divided into 16 ounces of 437·5 grains each, and drachms of 16ths of an ounce, or 27·34375 grains, 14 pounds are a stone, 28 pounds a quarter of a hundred, and 112 a cwt. Troy pounds are 12 ounces of 480 grains, in 24 pennyweights, and 12 ounces. Apothecaries divide the troy ounce of 480 grains into 8 drachms of 60 grains, and 3 scruples of 20. *(For* Time, *and for other details, see the following articles.)*

THE FRENCH SYSTEM.

The French Republican Government, in 1793, adopted a *Natural* standard in the measure of the Earth's meridian from the Equator to the Pole. This they found by the best determinations to be about 5130740 toises of 6 French feet, or 6 feet $4\frac{3}{4}$ inches English. Then dividing this into *ten million* parts, they obtained a *standard metre* of $\frac{5130740}{10000000}$ toise, or in English measure of 39·37079 inches; 3·2809 feet, or 1·093633 yard.

It was a decimal division with other divisions by 10, and multiples by 10, in the *decametre* of a ten times the *kilo* (or *chylo*) metre, of 1000 times, and the myrio-metre of 10,000. Then descending they had the

deci-metre as a tenth, the centi-metre 100th, and the milli-metre, or 1000th.

The same Standard being also known to other nations in their conventional measures, relations were thus established between the same 10 millionth and other foreign measures.

In our miles the prime standard is nearly 6213·875 miles, then the 10 millionth of this is 39·37079 of our inches; and this, in tenths and tens, fits the French decimal scale to our measures. Then, by connecting this with a cube of water of given dimensions in the standard scale, they afterwards got weights and cubic measures. Thus, the kilogramme, 1000 of their grammes, weighs in English grains 15·434 or 15·438, and in French grains 18827·15; so that we thereby established that their grain is to ours as 15·438 to 18·827.

These divisions were also applied to *Agrarian* measures in Hectares of 10,000 *square* metres, Ares of 100 square metres, and Centiares of 1 square metre. The *Setier*, old Corn measure, is 1·56 Hectolitre, and 1 Hectolitre is 0·641 Setier.

To *Liquids* in Decalitres of 10 decimetre cubes of water. In *Litres* of the decimetre cube, and in Decilitres of the 10th.

To *Dry measures* in the *Kilolitre*, or metre cubed, or 1000 decimetre cubes; the Hectolitre of 100 decimetre cubes, and the Litre or Decimetre cube.

For *Cubic measure*, the *stere* was the metre cubed, and the Decistere the 10th of the metre cubed.

For *Weights*, the Kilogramme of 1000 grammes is the accurate weight of a decimetre of water, and 2·042876 French pounds, and 2·205 English. The Quintal is 100 Kilogrammes, and the Millier 1000. Then there is the Hectogramme, Decagramme, and Decigramme all in use.

Metre	39·37079 English inches.
Gramme ...	15·438 grains.
Are	1076·4414 square feet.
Stere	35·3171 cubic English feet.
Litre	61·028028 cubic Eng. inch.

They are of course readily converted into *multiples* of the standards, by prefixing *deca* for ten times the standard; by *hecto* for hundreds, and by *kilo* for thousands, by merely changing the place of the decimal point.

For measures of length in ten millionths of a quadrant for the metre, the following is the Decimal scale in our inches:—

	Eng. Inches.
1 Millimetre	0·03937079
1 Centimetre .. .	0·3937079
1 Decimetre	3·937079
1 METRE	39·37079
1 Decametre	393·7079
1 Hectometre	3937·079
1 Kilometre	39370·79
1 Myriometre	393707·9

We readily bring these into other English measures, by dividing the divisible by 12 for feet, 36 for yards, or 63,360 for miles. The myriometre is 6·2138 miles.

The Centimetre is $\frac{1}{0·39}$ &c. *i. e.* 2·54 centimetres nearly to the inch, and the Millimetre being a tenth of that is 25·4 millimetres to an inch, a number to be remembered since it is often used.

A Toise is 1·94904 metre, *i. e.* 6 feet, 4·7352 inches English. A Metre is 0·513074 toise. A Pied is 0·32484 metre, and a Pouce is 0·02707 metre.

For WEIGHTS we have in like manner:—

	Eng. Grains.
1 Milligramme	0·015438
1 Centigramme	0·15438
1 Decigramme	1·5438
1 GRAMME (18·8 *French*) ..	15·438
1 Decagramme	154·38
1 Hectogramme	1543·8
1 Kilogramme	15438
1 Myriogramme	154380

Then, by dividing by 27·34375 grains for drachms, by 437·5 for ounces, and 7000 for pounds, we get the corresponding English measures in other denominations.

For measures of capacity the *Stere* is taken as 35·3171 &c. cubic *feet*, or 61·02803 cubic *inches*, and the litre is its 1000th, or the millistere, *i. e.* 61·02803 cubic inches taken as the standard, and making the myriolitre, or 10,000 1 Stere. For Litres of 61·02803 cubic inches, the change of decimal points is as under:

	Eng. Cub. In.
1 Millilitre (1000th) ..	0·06102803
1 Centilitre (100th) ..	0·6102803
1 Decalitre (10th) ..	6·102803
1 LITRE (*Standard*) ..	61·02803
1 Decalitre (× 10) ..	610·2803
1 Hectolitre (× 100) ..	6102·803
1 Kilolitre (× 1000) ..	61028·03
1 Myriolitre (or STERE) ..	610280·3

The Stere may then be made the Standard, and a similar series adopted.

English measures being in cubic inches, we determine the relations by division by 277·274 cubic inches for our gallon, and its parts and multiples, *i. e.* by $\frac{1}{4}$ = 69·3185 for our quart; by 36 = 9981·858 for our barrel, *i. e.* a kilolitre is a little above 6 barrels. In bushels of 2218·193 cubic inches, there are about 2·75 to an Hectolitre, and 1 bushel is 36·347664 Litres. A quart is 1·13586 litre, and our gallon 4·543458 litres, or 0·454458 Decalitre, or 45·43458 Decilitres, and so on in tenths. A Litre is 0·220967 gallon, and an Hectolitre 22·0967.

We might, in like manner, proceed through the Ares, the Steres, but it may be sufficient to state, that our rood is 10·116775 ares, our acre 0·404671 hectares, 1 Are 0·098845 rood, 1 hectare 2·473614 acres. And that the Stere contains 61,028 cubic inches nearly, the Litre being the Millistere.

1 square Toise is 3·7987 square Metres; and 1 square Metre is 0·2632 square Toise. 1 cubic Metre is 0·135064 cubic Toise, and 1 Toise cubed is 7·4039 cubic Metres.

The Arpent was 3418·87 square Metres, the Are being 100, and the Hectare 10 000, so that 1 Arpent was 0·3119 Hectare, and 1

Hectare 2·9249 Arpens. 1 French pound was 0·4895 Kilogramme.

A Kilogramme is 18827·15 grains, and the ancient pound was 9216 grains. An Hectolitre of wheat weighs about 75 Kilogrammes. 100 Grammes are 1882·7 grains, and a Decigramme is 1·88 grain. A Kilogramme is 2·0429 old French pounds.

The French have 2 perches of 18 French feet, and 22; and 2 arpens of 48,400 square feet, and 32,400 square feet.

28 inches of the English barometer is 711·19 millimetres French; 29, is 736·59; and 30, is 761·99.

To reduce metres into our yards, multiply by 1·09364 yards; and yards into metres by 0·914318.

To convert grammes into grains, multiply 15·438; or, grains into grammes by 0·064793.

To convert kilogrammes into pounds avoirdupois, multiply by 2·20486; or pounds into kilogrammes by 0·45354.

To convert litres into cubic inches, multiply by 62·028028. The contrary by 0·01639.

To convert hectolitres into imperial bushels, multiply by 2·7513. Contrary 0·36347.

To convert hectares into acres, multiply by 2·473614. Acres into hectares by 0·40467.

For kilometres into miles, by 0·62138. For miles into kilometres, by 1·6102.

For Lieues de Post into miles, multiply by 2·4222; and for miles into Lieues by 0·4128.

The French, also, often use a decimal division of time. A day is 10 hours, each 2 common hours and 24 minutes; an hour is 100 minutes, each 1 minute 26·4 seconds of the new division, &c. &c.

Angles are also divided decimally. Thus 100 minutes is a degree, each 32″·4 sexagesimal seconds. A degree is 54 minutes, and a quadrant is 100 degrees. So also a minute is 1′·85″ centesimal, and a degree 1°·11′·11″·11 centesimal.

Their meridional degree (less than the equatorial) is 69·0429. Their centesimal degree 62·13837. The myriametre is the 10th of a decimal degree.

In retail business the French adopt the old names in quantities according with the new measures. Thus they have the toise *usuelle* of 2 metres, the pied *usuelle* of one-sixth, &c. &c.

The Netherlanders use the French standards under other names. The gramme as the Wigtye, the Metre as the Elle, the Litre as the Kop, dry, and the Kan, liquid; other nations also adopt them.

As the French metre is 39·37079 inches, and our pendulum 39·1393 inches, it has been regretted that the two were not combined, or that the equatorial pendulum 39·015 was not adopted as the standard of all nations. The French is, undoubtedly, the most universal natural standard, since pendulums vary from 39·015 to 39·21765, owing to the shortening of the sines of the spheroid. Our yard, or Henry the Third's arm, of 36 inches, and our barley-corns of 3 to an inch, are vague and merely conventional.

Russia has had its commission of weights and measures, and they determine a cubic inch of water at 62, to be 368·261 doli, the coined pound being 25·019 English cubic inches. The Stoof, of 3 pounds, 75·0568 cubic inches, the Wedro, 30 pounds; the Garnez, 8 pounds; the Tschetwert, 512 pounds. The Archin 24 inches, and the Saschen 84 inches. The English gallon is 0·33777 the Russian Wedro.

MEASURES OF CAPACITY.

Capacity is length, breadth, and thickness, estimated by known measures. There are $12 \times 12 \times 12 = 1728$ cubic inches in a cubic foot; and $3 \times 3 \times 3 = 27$ cubic feet in a cubic yard.

Till the Act of 1824, we had three several gallons: the *wine*, of 231 cubic inches, holding 8 lbs. 5 oz. 6¼ drs. of pure water—the *corn*, of 268·8, holding 9 lbs. 10 oz. 1¾ drs. —and the *ale*, of 282, holding 10 lbs. 2 oz. 11¼ drs.—but now, instead of these, we have one standard *Imperial* gallon, of 10 lbs. of pure water and 277·274 cubic inches.

In *grains* of pure water, the old *wine* gallon weighed 58380 grs.; the *corn* gallon 67423; the *ale* gallon 71189; but the new *Imperial Standard* general gallon weighs 70000 grains; or contains 10 lbs. avoirdupois of distilled water, weighed in air, at 62°, with the barometer at 30 inches.

It is to the cubic foot of 1728 inches, as 1 to 6·2321, so that a cubic foot contains 62·321 lbs. of water, or 997·137 oz., usually taken as 1000 oz.

The cube-root of 277·274 is 6·5208 inches; hence, a vessel of that length, breadth, and depth is an imperial gallon.

Close approximations may be made, by considering every 6 gallons of wine as 5 of imperial. Every 59 gallons of ale as 60 imperial. And every 32 corn bushels as 31 imperial bushels.

Size of vessels:—

Bushel......	8 in. dept,	18·8125 in. diam.
Half bushel	6·375 „	14·875 „
Peck	5·0625 „	11·8125 „
Gallon	4 „	9·375 „
Half gallon	3·1875 „	7·4375 „
Quart......	2·05 „	5·9375 „

The old Winchester bushel was 18½ inches diameter, and 8 inches deep, containing 2150·42 cubic inches.

5 oz. of water, are	1 gill,	or	8·664 c. in.
4 gills	1 pint,	„	34·659 —
2 pints	1 quart	„	69·318 —
4 quarts	1 gall.	„	277·274 —
2 gallons	1 peck	„	554·548 —
4 pecks or 8 galls.	1 bush.	„	2218·192 —
8 bushels........	1 quar.	„	17745·536 —
5 quarters	1 load	„	88727·680 —

The Imperial Bushel is equal to a cube 13·04172 inches each way, and a Winchester Bushel to a cube of 12·9078 inches.

The old standard bushel, at Guildhall, contained 2145·6 cubic inches of water, weighing 1131 oz. 14 dwts.

A tun is 2 pipes, 4 hogsheads, 3 puncheons, 8 barrels, or 252 gallons.

A barrel of 36 Imp. gallons is 9981·864 cubic inches, and a firkin of 9 Imp. gallons 2495·466 cubic inches.

Coals are sold by the ton, of 2240 lbs., in ten sacks. The chaldron was 28 cwt.

Ankers, runlets, tierces, &c. are irregular, and require to be guaged.

To find the contents of a cask in imperial gallons, guage the bung diameter, and multiply its square by 2. To the product add the square of the head diameter, and multiply these by the inside length. Then divide the last product by 1059, or more accurately by 1058 7 for Imp. gallons.

A Scotch pint is 105 cubic inches.

A wheat firlot 21¼ Scotch pints.

The Scotch quart is 206·8 cubic inches.

A Scotch boll is an English sack.

The Scotch pint is 55 oz. troy of Leith water.

The Imp. fluid oz. is 437·5 grains, and 1·7329625 cubic inches. The old fluid oz. was 455·73 grains. The 20th of an Imp. pint the 16th of a wine pint.

A table spoonful is about half a fluid ounce, or four drachms; a tea spoonful one fluid drachm; a dessert spoonful two fluid drachms. A tea cupful is three to four fluid ounces, and a wine-glass one and a-half fluid ounce.

A last is a commercial measure, of 12 barrels of soap, ashes, herrings, &c.; 10 quarters of corn, or two cart loads; 24 barrels of gunpowder; 12 sacks of wool; of salt 18 barrels, and a hundred of salt is 126 barrels.

A barrel of soap is 256 lbs. and of herrings 32 lbs.

A load of earth is a cubic yard. A cord of wood is 128 cubic feet.

A ton of a ship is 42 cubic feet, or 3·476 feet each way.

A tub of butter is 84 lbs., a firkin 56.

A bushel of wheat is about 60 lbs., rye 53, barley 47, oats 38, peas 64, beans 63, clover-seed 68, rape 48 lbs., flour 56 lbs.

24 cubic feet of sand, 18 of earth, or 17 of clay are a ton. A yard of solid earth is 27 bushels, or a load.

A soldier's canteen is three pints.

7 lbs. avoirdupois is a gallon of flour.

19 cubic inches of distilled water, at 50°, weigh 10 oz. troy.

The difference between 62° and 39° Fahrenheit, in a gallon of 277·274 inches, is one-third of a cubic inch.

The Committee on whose report the Act of 1824 was passed, stated that the specific gravity of Thames water to distilled and rain water, is 1·0006 to 1, being 1-6th of a cubic inch in a gallon. That the temperatures of 62 and 39 vary the bulk of a gallon of water ⅓rd of a cubic inch. And that a cubic inch in a vacuum weighs 252·722, *i. e.* 264 more than in air. They also determined the specific gravity of water to be 1 at 62°; 0 99913 at 70°; and 1·00113 at 40°, 39°, and 38° Fahrenheit.

A pipe of Port is	115	Imp. gallons.
——— Lisbon	116⅔	——
A pipe of Madeira	91⅔	Imp. gallons
——— Sherry, &c. ..	100	——
A butt of Mountain ..	108⅓	——
The hogshead of Claret	51·61	——
An aum of Hock	30	——
——— Teneriffe ..	100	——
——— Cape	16⅔	——
Hogshead of Molasses	83⅓	——
Tun of Vegetable Oil..	196⅔	——
An anker of Brandy ..	8⅓	——

	Imp. Galls.
The Amsterdam Wine Stekan, is	4·27
——— Brandy	4·129
Antwerp Stoop	0·648
Barcelona Carga	27·236
Bourdeaux Barreque	51·61
Burgundy Quartout	22·631
Champagne Ditto	19·821
Cognac Velte	1·608
Danish Anker	8·236
Dantzic Ohm	32·971
Dutch Aum	34·080
Gallipoli Oil Salma	14·231
Hamburgh Ohm	31·867
Irish Gallon	0·785
Leghorn Barile, Wine 10, Oil ..	7·357
Lisbon Almude	3·641
Marseilles Millerole	14·154
Messina Wine Salma............	19·226
——— Oil	2·575
Nantes Wine Barreque	52·816
Naples Oil Salma	35·647
Oporto Almude	5·608
Prussian Eimer	15·118
Rome Wine or Oil	12·75
Rotterdam Ohm	33·318
Spain Wine Arroba	3·538
——— Carga	30·609
Vienna Eimer	12·449
Zante Barile	14·682

Foreign Dry Measures, in Bushels:—

The Alexandrian Rebebe, is	4·372
Amsterdam Mudde	3·06
Basil Sack	3·554
Bergen Toende	3·836
Berlin Scheffel	1·438
Bern Mutt	4·625
Bologna Corba	2·03
Bourdeaux Boiseau	2·11
Bremen Scheffel	1·955
Cadiz Fanega	1·55
Cairo Ardeb	3·
Canada Minot	1·054
Canary Fanega	1·77
Cologne Malter	4·459
Constantinople Killow	0·912
Danish Toende	3·9472
Embden Tonne	5·272
Florence Stajo	0·669
Geneva Coupe	2·135
Genoa Mina	3·426
Hague Sack	2·946
Hamburgh Scheffel	2·899
——— Last..........	11·2 quarters
Leghorn Sacco	1·999
Malta Salma	7·969
Munich Scheffel	9·976
Nantes Setier	3·939

Naples Tomolo	.... 1·407
Netherlands Mudden	.... 2·751
Prussian Scheffel	.... 1·5591
Persian Artaba	.... 1·809
Portuguese Moyo	.... 23·03
Riga Loop	.... 1·878
Roman Rubbio	.... 8·1
Russian Chetwert	.... 5·77
Scotch Wheat Firlot	.... 0·991
——— Barley Do	.... 1·444
Spanish Quarteros	.... 1·9416
Sicilian Salma	.... 7·611
Swedish Tunna	.... 4·030
Trieste Stajo	.... 2·272
Tuscan Stajo	.... 0·691
Vienna Metzen	.... 1·691
Zante Misura	.... 0·579

A Roman quadrantal was a cube containing 80 lbs. of water, or 48 sextaries and 8 congii. A gower was 7 pints.

The *Ephah* was 1747·7 cubic inches, nearly an English cubic foot.

The Jewish *omer* or corus was 75·625 gallons liquid; and 32·125 pecks dry.

By measure, the gallon is 8 pints, 128 fluid ounces, 1024 fluid drachms, or 61,440 minims. The minim (marked ♏,) is the 60th of the fluid drachm (f. ʒ,) and 8 fluid drachms are a fluid ounce (f. ℥,) and 20 fluid ounces are an Imperial pint.

WEIGHTS.

Weight of bodies is their force of *motion* towards the centre of a Planetary sphere, which itself has an orbit motion, common to all its parts; and, also, a rotatory motion in all parts distant from the centre. The two forces produce, as usual, a diagonal increase of velocity, directed on every side to the common centre, and this is weight, or the sublime mechanical means of aggregation in a loose planetary mass. The reaction of two opposite sides quadruples the rotatory inverse, or centrifugal force, and the effect (as taken in round numbers) in a second, is directly as the orbit of velocity 97,895 feet, and inversely as four times the rotative velocity, 6088 feet, that is 16·0841 feet; or, if we take the deflection perpendicularly 969 feet, as a radius of motion all round, and multiply by 6·283 for the circle, we also get 6088 as the inverse force.

In parallels of latitude, the diminished velocity of rotation, in cosines, is compensated by the sines, and the squares of the cosines and sines are everywhere equal to the square of the radius. Owing, however, to sines in an oblate spheroid being too little, the inverse force of rotation diminishes from the Equator to the Poles, and the quotient or fall is greater.

Time of falling, also, increases the weight or force, because the motions generate areas which are to each other as the squares of their uniform times.

A body which at the Equator weighs 100, at Paris (latitude 49.) weighs 100·3088. At London (51·31,) 100·3338; and at lat. 70, 100·4812. A pendulum at the Equator is 39·0083; at 45°, 39·1135; at Paris it is 39·1287; at London 39·1393, and at 70°, 39·196, and computed at the Pole to be 39·2208; so that 180 lbs. at the Equator would be 181 at the Pole.

The English standard of weights is the cubic inch of distilled water, weighing 252·458 grains in air, and 252·722 in vacuum.

The troy lb. is 5760 grains, or 22·8157 inches of pure water.

The avoirdupois lb. is 7000 grains, or 27·7274 inches. 10 avoirdupois lbs., or 277·274 cubic inches of water, are the imperial gallon; and 12·15 lbs. troy are the same gallon.

One troy lb. is 0·822857 avoirdupois lbs.

One avoirdupois lb. is 1·215278 troy.

The lb. avoirdupois is 453·25 French grammes, and the lb. troy is 372·96 French grammes.

The lb. avoirdupois is 0·453544, the French kilogramme, 0·936374 the Hamburgh lb., and 1·108926 the Russian lb.

The lb. troy is 0·373202 kilogramme; and 0·770502 the Hamburgh lb.

In Avoirdupois Weight, 16 drs. make an oz.; 256 a lb.; 16 oz. a lb.; 112 lbs. a cwt.; and 20 cwt., or 2240 lbs., a ton.

In Troy Weight, 24 grains make a pennyweight, (meaning grains of wheat) 480 an oz., or 20 dwt. an oz. and 12 oz. a lb.

One lb. troy, or Apothecary, is 13 oz. 72·5 grains avoirdupois.

One lb. avoirdupois is 1 lb. 2 oz. 4 dr. 2 scr. apothecary; or 1 lb. 2 oz. 10 pennyweights, and 16 grains troy.

The apothecary's and troy ounce is equal to 1 oz. and 42·5 grs. avoirdupois.

A drachm is 27·475 grs., an oz. 437·5.

175 lbs. troy, are equal to 144 lbs. avoirdupois, and 14 lbs. avoirdupois are 80 grains above 17 troy.

80 oz. avoirdupois are 73 oz. troy.

In Apothecaries' Weight, 20 grains make a scruple, 60 a drachm; and then, as in troy weight, 480 make an oz. and 5760 a lb. There are 12 oz. to the lb., 8 drachms to an oz., 3 scruples to a drachm, and 20 grains to a scruple.

The avoirdupois lb. of 7000 grains is divided into $16 \times 16 = 256$ parts or drachms, each 27·34 grains. The *apothecaries* lb. of 5760 grains into $12 \times 8 \times 3 = 288$ parts, or scruples, each 20 grains. And the troy lb. of 5760 grains into 240 parts or pennyweights, each 24 grains.

Apothecary Weight.			*Avoirdupois.* oz.	qr.	grains.
℥ix	.. ..	=	9	3	54·375
℥vj, or lbss	..	=	6	2	36·250
℥iij	.. ..	=	3	1	18·125
℥ij	.. ..	=	2	0	85·000
℥j	.. ..	=	1	0	42·500
ʒiv, or ℥ss	..	=		2	21·250
ʒij	.. ..	=		1	10·625

Taking the avoirdupois lb. at 7000 grains, or as 1: the ounce is 437·5 grains, or 0·0625; and the drachm 27·34 grains, or 0·0039. And the troy or apothecaries of 5760 grains, or 1; then the *ounce* is 480

grains, or 0·08333; the *drachm* 60 grains or 0·0104; the *scruple* 20 grains, or 0·0035; the *minim* 1 grain, or 0·0001735.

A drop is taken to be a grain.

In diamonds, &c. we have the 20th of a grain, called a mite, of which there are 115,200 in a pound troy.

For scientific purposes the grain only is used; and sets of weights are constructed in decimal progression from 10,000 grains downwards to 100th of a grain.

Henry III. directed that an ounce should be 640 dry grains of wheat; 12 ounces a pound; 8 pounds a gallon of wine; and 8 gallons a London bushel.

A bale of Egyptian cotton is 90 lbs., of Brazil 160, of Georgian and Sea Islands 280, Orleans 300, East India 300, West India 350 to 400.

A seam of glass is 120 pounds.

A sack of wool is 22 stone of 14 lbs. or 308 lbs. In Scotland, it is 24 of 16 lbs. A pack of wool is 240 lbs. A tod of wool is 2 stone of 14 lbs. each.

12 sacks is a last, 4368 lbs. or 39 cwt.

56 or 60 lbs. is a truss of hay, old or new, and 40 lbs. a truss of straw; 36 trusses a load.

A fodder of lead is 19½ cwt. in London, and 21 cwt. in the North.

A bushel of rock-salt is 65 lbs., of crushed salt 56 lbs., and Foreign salt 84 lbs.

A man's load is 5 bushels, a market load 40, or 5 quarters.

A keel of 8 Newcastle chaldrons is 15½ London chaldrons.

A tierce of beef, in Ireland, is 304 lbs., and of pork 320 lbs.

A legal stone is 14 lbs., or the 8th of an cwt. in England, and 16 lbs. in Holland.

Forty cubic feet of rough timber is a load, and 50 of hewn. A load of 1-inch plank is 600 feet.

The chief weights of other countries are in grains as under:—

Amsterdam, pound	7625
Berlin, ditto	7231
Bern, ditto	8060
Cairo, rottolo	6650
China, catty	9333
——— kin	5802
Cologne, pound	7216
Constantinople, oke	19830
——— pound	7578
Copenhagen, ditto	7720
Dutch, troy pound	7620
Florence, libra	5240
France, livre	7555
——— kilogramme	15434
——— livre, usuelle	7717
Hamburgh, pound	7476
Irish, pound	7774
Japan, catty	9100
Leipsic, pound	7206
Lyons, poids de soie	7087·5
Malta, rottolo	12216
Marseilles, pound	6296
Mecca, rottolo	7144
Morocco, pound	8330
Naples, piccolo	7420
Ormus, seer	4675
Persia, cherray	98771
Poland, pound	6296
Portugal, arratel	7083
Revel, pound	6652
Rome, libra	5234
Russia, pound	6318
Scotch, trone pound	9600
Smyrna, pound	6944
Sweden, commercial	6563
Ditto, mining	5801
Trieste, pound	8639
Tripoli, rottolo	7840
Vienna, pound	8645

Variously divisible in different nations.

In decimals of the English pound avoirdupois:—

Barcelona, pound	0·901775
Basle, pound	1·079291
Berlin, pound	1·031236
Bremen, pound	1·099121
Cadiz, occa	1·016192
Cologne, mark	0·526299
Danish, pound	1·100945
Florence, pound	0·748582
Frankfort — 1·114138	1·031609
Genoa (silk) libbra	0·756394
Hamburgh, pound	1·067949
Lisbon, libbra	1·011954
Milan, libbra	1·660733
Naples, libbra	0·707759
Polish, stone	28·631801
Rome, lira	0·747947
Russia, pound	0·901773
——— pud	36·070933
Swedish, pound	0·93384
Turkish, rottel	1·406374
——— cantar	165·014636
Venice, libbra	1·051713

The Quintal, in America, is 100 lbs., in France, 220·486. In Spain, 101·5, or 104 lbs. *i. e.* 4 arrobas. Italy, 100. In Turkey, 124·5. In England, when used, 120 lbs., called the long hundred.

The *Schippondt* of the northern nations is, in Sweden, for copper 320 lbs. of 9211 grains, and for provisions 400 such lbs. At Riga 400 lbs. of 6149 grains. At Hamburgh 300 lbs. of 7315 grains.

100 lbs. English, are equal to 112¾ lbs. of Russia, 93 lbs. 5 oz. at Hamburgh, 132 lbs. 11 oz. at Leghorn, and 104 lbs. 13 oz. in Portugal, 91 lbs. 8 oz. at Amsterdam, 152 lbs. at Venice, 154 lbs. 10 oz. at Naples, and 97 lbs. at Cadiz.

A tale, in China, is 579·8 grains, about 1-12th of a lb. A catty is 16 tale, and 100 catties are 1 pecul, 133⅓ lbs. The Chinese sell all goods and liquids by weight.

In India the weights are the paddy or the grains of rough rice, each of which is equal to about 2-5ths of a grain; the gulivindum weight, or that of a jumble bead, equal to about 1 grain 5-16ths; the retti weight, equal to about 2 grains 3-16ths. The gold fanam weight equal to 8 grains; and the star pagoda to about 84 grains.

The Bengal maund is 74 lbs. 10 oz. 10⅔ drachms; the seer 1 lb. 13 oz. 13·866 drachms; the chattock 1 oz. 13·366 drachms. The Bazar maund is 82 lbs. 2 oz. The Mysore cutcha seer is 9 oz. 11⅓ drachms.

A miscal, at Bassora, is 72 grains. The maund is 90 lbs. 4 oz. The oka is 47·5 oz. avoirdupois.

In Greece, a drachma was 107 grains. A minæ 1 lb. 1½ oz. A talent 67 lbs. 7 oz. 5 dwt.

The Roman weights were the as, equal to 12 oz., and the uncia, 1 oz.

MEASURES OF LENGTHS.

Measures in length are the distance of one object from another in some agreed standard.

The pendulum which vibrates seconds 39·1393 inches at London, has been a proposed new standard for British measures. One mile of 1760 yards, would be equal to 1618 833 such pendulums. An inch is 0·02555 of the pendulum.

The smallest measures are the hair's breadth, of which 48 are an inch.

Four barley-corns laid *breadth-ways*, are 3-4ths of an inch, called a *digit;* and 3 barley-corns *length-ways* are an inch.

A barley-corn decimally is 0·1875 of an inch; and lengthways 0·333.

The inch is also divided into 12 lines; and by workmen into 8ths.

The French divide their inch into 12 lines, but as their inch is longer than the English, as 1·066475 to 1, so their line is to the English as 12 to 11·26.

In decimal divisions the 8th of an inch is 0 125; an inch is the 0·0833 of a foot; a foot the 0·333 of a yard. Our line is 0·0833 of an inch. An inch is 2 539954 French centimetres, &c.

A nail, used in cloth measure, is 2¼ inches, or the 16th of a yard.

A hand, in horse measure, is 4 inches.

A palm is 3 inches, and a span is 9 inches.

A *Pole* is 5½ yards, or 16½ feet; and 40 poles, or 220 yards, are a *furlong*, or the eighth of a mile. 320 poles, or 1760 yards, a mile.

The fathom, 6 feet, is derived from the heighth of a full-grown man. The gyrd, girth, or yard, is 3 feet, the cubit or arm 18 inches, the foot 12 inches, and the span 9 inches. The hands' breadth 4 inches, the thumbs' breadth 1 inch.

The cubit, taken from the elbow to the wrist, was 13 inches; but the Greeks, Jews, &c. took it to the end of the middle finger, 18 or 19 inches.

A geometrical pace is 4 feet and 4·8 inches, but in common use it varies. Six paces, in France, are equal to 5 toises.

The French toise was 6·395 English feet. The mile was 1000 toises, and the lieue 2000.

The foot is universal, and varies from 11 to 14 inches. In general, it is a fraction between 11 and 12 inches. The Rhinland, adopted throughout Germany, is 12 35 inches English. The palmo is much used in Italy, and is between 8 and 10 inches.

Our yard of 36 inches has no counterpart in continental measures, except the Vara of Valencia 36·62, and the Persian Guerze 37·21, and Arish 38·27.

We have had five standard yards, varying from 35·99934 to 36·00249 inches.

In Decimals of a Yard:—

Barcelona, vara	0·864697
Berne, ell	0·593325
Brabant, ell	0·767025
Bremen, ell	0·632555
Castile, vara	0·927355
Danish, aln	0·686458
Dresden, ell	0·619564
Frankfort, ell	0·598523
French, aune	1·312369
——— metre	1·087016
Genevese, ell	1·250788
Genoa, palma	0·273222
Hamburgh, ell	0·62663
Lisbon, vara	1·195275
Neapolitan, canna	2·306865
Polish, ell	0·629032
Roman, canna	2·188061
Russian, arschin	0·778107
Swedish, ell	0·649327
Venetian, braccio	0·698175

In Decimals of a Foot:—

Barcelona, canna	5·188184
Bolognese, foot	1·244773
Danish, foot	1·029677
Frankfort, foot	0·933743
French, pièd	1·065765
Genevese, foot	1 600868
Hamburgh, foot	0·939945
Lisbon, foot	0·717165
Neapolitan, palmo	0·864943
Polish, stopa	1·169381
Spanish, pies	0·927362
Swedish, foot	0·973394
Swiss, foot	0·984351
Rheinland	1·029721
Russian, foot	0·992155

The Jacktam of Guinea is 4 yards.

The Covid of China is but 14·62 inches, and at Bombay 18 inches. The Guz, in Asia, varies from 19 inches at Mocha to 38·7, at Gambroon, probably halved, or doubled. The Japanese Inc is 74·9 inches.

The Amsterdam foot is ·927 English.

The candi of India is 2 feet 1 inch.

The Roman *braccio* is 4 palms. The *canna* 8 palms, or 24 inches.

The Levant pig is 2 feet 4 inches.

The Calcutta cubit is 17·6 inches; the Turkish cubit 26·33; and the Smyrna 27. The two Egyptian and Hebrew cubits were natural, 17·71, and royal, 20·66.

In Siam, the ken is 36 inches nearly, and is divided into 2 socks. These into 2 keubs, and each keub into 12 nions, at ¾ of an inch.

The Jaghire is 10·46 English inches.

A *statute* mile is 1760 yards, or 5280 feet, or 63360 inches.

An Irish mile is 2240 yards, or 1·2727 English. A Scotch mile is 1984 yards, or 80 are equal to 91 English.

11 Irish miles are 14 English, the perch being 7 yards in Ireland, instead of 5½, as in England.

In yards, a degree is 121593 3; hence, there are 69 0805 English miles, or 69 1-12th miles to a degree, (not 69½).

A 60th, or a minute, is 1·15134 mile.

A nautical mile, the 60th of a degree, is 2026·5 yards; a marine league, or 20 to a degree, is 6079·5 yards.

The log-line is divided into spaces of fifty feet, and the way measured by a half-minute sand-glass, which bears nearly the same proportion to an hour that fifty feet bear to a mile.

Leagues and miles of most nations are fractions of a degree; as the 15th of 8106 yards, the 20th of 6080, the 25th of 4864, the 30th of 4053, or the 60th of 2026·5.

The Arabian mile is		2143 yards.
The Roman	..	1628 or 2025
The Werst	..	1167 or 1337
The Tuscan	..	1808
The Turkish	..	1826

Our league, or 3 times our geographical mile of 60 to a degree, or 2025 yards, is 6075 yards, approaching continental measures.

The Brabant league is	6096
The Danish and Hamburgh league	8244
The German league	8101
The long German ditto	10126
The short ditto	6859
The Portuguese league is	6760
The Spanish	7416
The Swedish	11700

All of them parts of a degree, but made before the length of a degree was accurately determined.

The great French league, 20 to a degree, or 6080 yards. The common French league is the 25th of a degree, 4868 yards, or 2·76 miles, equal to 2283 toises. 2 are 1 post.

The Neapolitan mile is the 60th of a degree, or 2026 5 yards.

The Italian mile is 1766 yards, and about 69 to a degree; it is also 1000 paces, of 5·3 feet.

The German mile is the 15th of a degree, or 4 sea miles, or 8106 yards, or 4·606 English statute miles.

The Vienna post mile is 8296 yards.

Swiss miles are 9153 yards, or 5·2 English.

Flemish miles are 6869, nearly 4 English.

Dutch and Prussian miles have 18·75 to the degree, or 6480 yards

Danish leagues are 14·25 to a degree, or 8240 yards.

Swedish leagues 11·8 to the degree, or 11,260 yards.

Swedish and Danish miles are 7341·5 yards, or above 4 miles English.

The Castilian league is 26 5 to a degree, 4637 yards, or 5000 varas of 11·12 inches.

The common Spanish and Dutch league is 17 5th of a degree, 6955 yards, or 7572 varas.

The Indian coss is 2894 yards.

Bengal coss is 6000 feet, or 1 mile, 240 yards.

The Chinese li, 200 to a degree, 608 yards.

Persian league 30 stadia, or 29 furlongs.

Persian parasang 6440 yards, or 3⅔ miles.

Turkish agachs are 22 222 to a degree, or about 6000 feet.

The berri, in Turkey, 66⅔ to a degree is 1827·3 yards. An hour is 3½ miles. A fursakh is 4 miles. The camel's pace is 2½ miles an hour.

A Spanish travelling hour, 20 to a degree.

The Greek studium was 600 English feet.

The Olympic foot was 12⅝ English inches, and the pythic nearly 9¾. The jugerum was 3.5ths of an acre. The keramion 8 imperial gallons. The attic mina was nearly an English pound avoirdupois.

The cubit of the Greeks and Romans was 18 inches. The Roman foot was 11⅗ English inches, and the mile 1611 yards. Their jugerum was 5980 square yards. The amphora was 7⅔ gallons, and the dolium 153⅓ gallons. Their pound was about 5000 grains, and their denarius 6d.

The Jews' great cubit was 22 inches, and the less 18 inches. 400 of the latter was a stadium, and 10 of these a mile of 6000 feet. 24 was a day's journey, and a sabbath day's journey 3500 feet. A comer was 65 pints, and an ephah 6½ pints. An homer was 75⅗ gallons, and an ephah 7½ gallons. A talent was 113⅞ lbs., and a shekel 6 ounces.

The Greek acæna was a 10 foot rod.

The Roman milliarium was 5000 feet.

A SURVEYOR's chain is 4 poles, or 66 feet, divided into 100 links of 7·92 inches. A square chain is 16 square poles; and 10 square chains are an acre.

Four roods are an acre, each containing 1210 square yards, or 34·785 yards, or 34 yards 28 inches each side.

Forty poles of 30·25 square yards each is a rood. And a pole is 5 yards and a half each way.

An acre is 4840 square yards, or 69 yards, 1 foot, 8½ inches each way; and 2 acres, or 9680 square yards are 98 yards, 1 foot, 2 inches each way; and 3 acres are 120 yards and a half each way.

A square mile, 1760 yards each way, is 640 acres; half a mile, or 880 yards each way, is 160 acres; a quarter of a mile, or 440 yards each way, is a park or farm of 40 acres; and a furlong, or 220 yards each way, is 10 acres.

Sides whose multiple makes 3097600 square yards is a square mile.

Of course, any length or breadth in yards, which multiplied make 4840, is an acre. So any which makes 1210 is a rood; and any 30·25 is a pole.

Every mile of mere hedge and ditch is about an acre.

The Irish acre is 7840 square yards. 121 Irish acres are equal to 196 English.

The Scotch acre is ·27 English, and 48 Scotch acres are 61 English. One Scotch acre is 1·270744 English. And one English acre is 0·786941 Scotch.

In other words, an English acre is a square of nearly 70 yards each way, a Scotch of 77½ yards, and an Irish of 88½ yards.

28 cubic feet of sand, 18 of earth, and 17 of clay, are deemed a ton. A cubic yard of earth, or gravel, is deemed 18 heaped bushels, and after being dug, 27 or a load.

A cawney is rather more than an acre.

A baggah is 1600 square yards, about a third.

A hide of land was one plough's work.

An ox-gang was 15 acres, or as much as one ox can plough in a year.

A hide of land was 100 or 120 acres, and five was a knight's fee.

GENERAL COMPARISON OF ENGLISH AND FRENCH MEASURES AND WEIGHTS.

LENGTH.

ENGLISH.	FRENCH.
1 Inch	.. 2·539954 centimetre.
1 Foot	.. 3·0479449 decimetre.
1 Yard	.. 0·91438348 metre.
1 Fathom (2 yards)	.. 1·82876696 metres.
1 Pole or perch (5½ yards) ..	.. 5·02911 metres.
1 Furlong (220 yards)	.. 201·16437 metres.
1 Mile (1760 yards)	..1609·3149 metres.

FRENCH.	ENGLISH.
1 Millimetre	.. 0·03937 inch.
1 Centimetre	.. 0·393708 inch.
1 Decimetre	.. 3·937079 inches.
1 Metre .. .. {	.. 39·37079 inches.
	.. 3·2808992 feet.
	.. 1·093633 yard.
1 Myriametre	.. 6·2138 miles.

SUPERFICES.

ENGLISH.	FRENCH.
1 Square yard	.. 0·836097 square metre.
1 Square rod	.. 25·291939 square metres.
1 Square rood, or 1210 sq. yards	.. 10·116775 ares.
1 Acre (484 square yards) ..	.. 0·404671 hectare.

FRENCH.	ENGLISH.
1 Square metre	.. 1·196033 square yards.
1 Are	.. 0·098845 square rood.
1 Hectare	.. 2·473614 square acres.

CAPACITY.

ENGLISH.	FRENCH.
1 Pint	.. 0·567932 litre.
1 Quart	.. 1·135864 litre.
1 Imperial Gallon	.. 4·54345794 litres.
1 Peck (2 gallons)	.. 9·0869159 litres.
1 Bushel (8 gallons)	.. 36·347664 litres.
1 Sack (3 bushels)	.. 1·09043 hectolitre.
1 Quarter (8 bushels)	.. 2·907813 hectolitres.

FRENCH.	ENGLISH.
1 Litre .. .. .. {	.. 1·760773 pint.
	.. 0·2200967 gallon.
1 Decalitre	.. 2·2009667 gallons.
1 Hectolitre	.. 22·009667 gallons.

WEIGHTS.

ENGLISH.—TROY.	FRENCH.
1 Grain (24 to the pennyweight)	.. 0·06477 grammes.
1 Pennyweight (20 to the ounce)	.. 1·55456 grammes.
1 Ounce (12 to the pound) ..	.. 31·0913 grammes.
1 Pound	.. 0·3730956 kilogram.

ENGLISH.—AVOIRDUPOIS.	FRENCH.
1 Drachm (16 to the ounce) ..	.. 1·7712 grammes.
1 Ounce (16 to the pound) ..	.. 28·3384 grammes.
1 Pound	.. 0·4534148 kilogram.
1 Quintal (112 pounds) ..	.. 50·78246 kilogrammes.
1 Ton (20 quintals, or cwts.) ..	1015·649 kilogrammes.

FRENCH.	ENGLISH.
Gramme .. .. .. {	.. 15·438 grains troy.
	.. 0·643 pennyweights.
	.. 0·03216 ounce troy.
Kilogramme .. .. {	.. 2·68027 pounds troy.
	.. 2·20548 pounds avoirdupois.

MONEY AND COINAGE.

MONEY is an article of conventional value, serving as a measure of the price of articles of use and merchandize. Coin is a portable and durable convenience, and the prices of all articles are accommodated to its quantity in any country. Money may be any metal, or a creditable engagement to pay; but metallic money is universal, and paper engagements are only national, and as to coin a debasement.

As every country at any one time has but a given amount of currency, so the comfort of the people depends on average distribution. Thus, if, for example, of 50 millions of public currency, in a nation of 5 millions of families, 100 hold 20 millions, and another 200 hold 20 millions, then there remains but 10 millions among 4,999,700 families, with great penury in the many, amidst enormous wealth in the few.

Money has a tendency to accumulate in few hands, in two or three centuries, owing to interest of money alone. At 5 per cent. every principal sum doubles in 14 years; at 7½, in 10½ years; and at 10 per cent in 7 years. In every fifty years, 5 per cent. raises 100,000*l.* to a million; at 7½ per cent., to a million and a half, and at 10 per cent. to two millions, collected from industry in the name of interest.

From this cause it is, that we have no record of any past people who have flourished in relative ascendancy more than two or three centuries. Their ruin is usually ascribed to some last cause, the power of which is but an effect. Owing to want of equal circulation, and equal distribution, public industry loses its elasticity, or enterprise emigrates.

Every increase of currency, whether of coin, debased metal, or paper, adds to nominal prices of commodities or property; and every decrease lessens the nominal prices. Currency is cheap when prices are high, and currency is dear when prices are low. If in 1738, articles could be bought for 5*s.* which in 1838 would cost 20*s.*, currency would be four times dearer in 1738 than in 1838.

The United Kingdom is apparently richer than other countries, because nominal prices are forced up by paper money and taxation; and, because there is a better economy of currency in the general habit of making lodgments with bankers, by which the monetary strength of a district is concentrated and redistributed as from a reservoir.

The present currency of England is about 32 millions of paper notes, and about 20 in gold, silver, and copper. Besides 28 millions of exchequer bills, and 300 millions of bills of exchange and promissory notes, which answer most purposes of currency.

Whatever increases the currency beyond the regular standard of the precious metals is a debasement, whether a base or alloyed metal, or paper. If it circulate with credit, it lowers the value of money, as to goods and property, and if it serve as currency it matters not that it may on demand be exchanged for coin. Money falls, and property valued in money rises. This is debasement of money.

The lowering the value of money is not the only ill-effect of debasement, for if effected in the period of social contracts, it reduces obligations of debtors to creditors, and buyers to sellers. Nor is the withdrawing it and contracting the currency less injurious, for then it ruinously increases obligations.

The debasement of the currency, *i. e.* the increase of the nominal price in money, of articles of property, varies in effect, according to the supply and demand, and to the necessity, stability, and fixed quantity of articles. It raises real property more than personal, and both kinds according to scarcity, or surplus. Hence, since the debasement by paper, land in fixed quantity has risen in price, and rent, from 500 to 1000 per cent. Houses from 200 to 500 per cent., owing to buildings and supply; while personal property has not risen generally above 1 or 200; where supply meets demand only from 50 to 100 per cent.; and in cases of constant surplus, as in labour, not above 20 or 30 per cent.

The financial operations of the British government, since the revolution of 1688, have been conducted on the virtual principle of *debasing* the currency. The first debt was only a charge on certain taxes; but, as it did not meet the exigency, new taxes were raised, and so on from 4 millions in 1690, to 73 millions in 1813, and 50 in 1838. This would have been equivalent to a total confiscation of all property for the expences of wars, had it not been for the *expedient* of simultaneously debasing the currency by an *alloy* of paper, so as to increase the amount, raise nominal prices of rentals, produce, &c.

The habits of the people obstructed the full effects of the debasement, till the increase of trade after the American war. The shopkeeping *negociators* in country towns then turned bankers, began to issue local notes, and to seek employment for their surplus capital. This led to innumerable enterprises, and to all that factitious circulation which doubled and trebled rentals, and since then has rendered success a lottery, and sober industry unavailing.

There was a British coinage long before the invasion of the Romans, though ring-money, common to ancient nations, also circulated in Britain.

Athelstan, in 928, first established uniform coin in England; and, after that time, the kings became the bullion merchants and coiners. In the reign of Henry III. the king's profit, or seignorage, was 6*d.* in the pound. Edward I. raised it to 1*s.* 2½*d.*

The Egbert silver coins were shillings, thrimsas, pennies, halflings, and feorthlings; their brass coin was a styca.

Alfred coined silver pennies and copper sticas, or half-farthings. The silver penny weighed 22½ grains; but in the time of Elizabeth it had dwindled to less than one-third; silver half-pennies and farthings were in use till 1560, and groats and half-groats.

At the Conquest, a pound in tale or coin

was equal to a pound of standard silver. Edward I. made it 20s. and 3d. in tale. Edward III. made it 25s. in tale. Henry IV. 30s. Edward IV. 37s. 6d. Henry VIII. 45s. Elizabeth, 62s., and George IV. lowered the tale to 66s. for a pound of silver; this is 3·3 less, per shilling, than at the Conquest!

Henry VIII. debased the gold coin from $23\frac{1}{2}$ carats pure and $\frac{1}{2}$ alloy, to 22 pure and 2 of alloy, which has been continued as the standard to our time.

Henry VIII. debased the silver coin to 4 oz. fine and 8 of alloy, so that a lb. of pure silver was coined into 13l. 6s. 4d. The silver thus became to gold as 7 to 3, and the gold was exported at a profit of 350 per cent.

Elizabeth restored the silver coin to 11 oz. 2 dwts. fine and 18 dwts. alloy.

The 20s. gold coin of Charles II. passed for 21s. (a guinea) because worth it in silver, and it long passed for 30s.

We have reduced our silver coin as 3·3 to 1, but the florin has been reduced as 6 to 1, the livre as 74 to 1, the maravedi as 1000 to 1, and the re as 1100 to 1.

We had no copper coins till 1610.

Gold coin was introduced by Edward III. in six-shilling pieces, nearly equal in size to a modern sovereign. Nobles followed at 6s. 8d., and hence the lawyer's fee; afterwards there were half and quarter nobles. Edward IV. coined angels, with a figure of Michael and the dragon. Henry VIII. coined sovereigns and half-sovereigns of the modern value. Guineas were the same size; but being made of superior gold from sovereigns, guineas passed for 21s., and, in 1798, at 30s.

The English silver penny of Edward III. was ordered to weigh 32 wheat grains from the middle of the ear. 20 of these pennies an ounce, and 12 ounces a pound. Eight pounds a gallon of wine, eight such gallons a bushel of wheat, and eight bushels a quarter.

The silver penny, being marked with a cross, was easily broken into a half-penny, and fourth-penny.

The Royal Mint, in England, was established in the 18th of Edward II.

The Royal Mint is conducted by a master, warden, deputy, comptroller, assayers, melters, weighers, clerk of the irons, engravers, &c. &c.

The English Mint has eight presses, which strike 60 blows per minute, and produces 3600 coins an hour, for ten hours; or, at least, 30,000 per day, making 240,000 for the eight presses. Good steel dies make 3 or 400 000 impressions.

Ingots of gold weigh 15 troy pounds each. Of silver from 50 to 60 pounds.

The mint has eight melting-furnaces, two cranes, and two pouring machines. The furnaces are used three times a day: and as each pot is about 420 pounds, they melt 10,080 pounds in a day of ten hours. The gold-pots are about 100 pounds, and melt it in an hour. The gold bars are rolled cold to the thickness of the coin, and the silver bars hot.

In gold and silver, the troy pound of 5760 grains is divided into 24 carats, each 240 grains; and the carat is sub-divided into four parts of 60 grains each, called carat-grains. As to pennyweights, of which there are $12 \times 20 = 240$ in a pound troy, the carat is 10 pennyweights, and the carat-grain is $2\frac{1}{2}$ pennyweights, or the 96th part of a pound.

The diamond carat is $3\frac{1}{5}$ grains. A pearl grain is $1\frac{1}{4}$ grain of 30 to the dwt.

Weights of English Coinage in 1838:

	oz.	dwt.	grs.
Sovereign	0	5	3·274
Half-sovereign	0	2	13·637
		dwt.	grs.
Sixpence		1	19·6363
Shilling		3	15·2727
Half-crown		9	2·[illegible]
Crown		18	4·3636

In England, the present relations of silver to gold are 14·2878 to 1.

In Holland, as 15·6736 to 1.

At Hamburgh, Venice, Petersburgh, and Bombay, as 15 to 1.

At Madrid, as 16 to 1, and Paris 15·5 to 1.

In China 14·25 to 1.

In Bengal 14·957 to 1, per Mohur and Sicca rupee.

The eagle and dollar are as 15·94 to 1.

The fineness of silver is expressed in ozs. and dwts. Thus, our standard silver is 11 ozs. 2 dwts. pure silver, and the remaining 18 dwts. is alloy. The fineness, therefore, is $\frac{222}{240}$, or 0·9125.

The fineness of gold is expressed in carats, as part of the 24 carats in a pound troy. Our standard gold is 22 carats out of the 24 pure gold, and the other 2 carats are alloy; that is, the pure gold in a pound of standard gold is 5280 grains, and the alloy is 480 grains. The fineness, therefore, is $\frac{5280}{5760}$ or $\frac{11}{12}$, or 0·917.

The standard price of silver is 5s. 2d. per oz., but our mint makes its issues at the rate of 5s. 6d. per oz., or 66s. per lb. troy.

There are 107,520 hal-pence in a ton of copper, worth £224.

A lb. troy of silver yields 66s., each 3 dwts. 15·2727, containing of fine silver 3 dwts. 8·7272 grains, and 6·5455 of alloy, at 11 oz. 2 dwts of fine silver to the lb.

A lb. troy of gold yields $46\frac{29}{40}$ sovereigns, each 5 dwts. 3·274 grains, containing 4 dwts. 17·001 grains of fine gold, and 10·273 of alloy, at 22 carats, or $\frac{11}{12}$ of fine gold to the lb.

The best alloy for gold coin is 1 oz. of silver and copper equal parts, to 11 ozs. of gold: and for silver coin 3·37ths of copper.

About $\frac{2}{3}$ of gold coins are purer than English coin, and 99 in 100 silver are worse, and many are half, and more alloys, as Turkish, Venetian, and some German; but Austrian, United States, Spanish, and Oriental, are nearest our standards.

917 of 1000 weight is the purity or *titre* of gold coins of England, United States, Portugal, Holland, Rome, Russia, and Aus-

tria; 900 of France; 901 and 875 of Spain; 896 of Naples; 903 of Prussia and Saxony; 876 of Sweden; 904 and 979 of Switzerland; 1000 and 896 in Tuscany; and 958 and 802 in Turkey. A pound of gold coin, of either country, is valued in these proportions.

In SILVER, the proportion of silver to gross weight is 925 in 1000 in coins of England; 900 of France; 833 and 500 of Austria; 875 to 688 of Denmark; 813 in Spain; 750 of Portugal; of Rome 916⅔; of the United States 903; of Naples 833⅓; of the Netherlands 941 to 583; of Russia and Prussia 750; of Saxony 823; of Sweden and Switzerland 878; of Tuscany 917, and of Turkey 802.

The total of the French coinage of gold and silver, from 1805 to 1832, was 140 millions sterling, or 3529 millions of francs, besides 2½ millions of copper, &c. The total of the British coinage, in the same time, in gold and silver, was £62,361,168. So that the coinage of France, in 28 years, exceeded that of the United Kingdom by 77½ millions.

French money is one-tenth alloy, so that the claim in exchange is nine-tenths of the weight, or 0·9. In English gold coin the alloy is 0·083; so that the claim is 0·917. An English sovereign weighs 7·980855, and is, therefore, in pure gold, as 1 to 0·917; *i. e.* 7·318444035 is the claim. Then the French Napoleon, or Louis of 20 francs, weighs 6·45161 grains, from which one-tenth gives 5·806449 pure gold; *i. e.* the two coins are as 5·8, &c. to 7·31, &c., or as to francs as 20 to 25·2079, the fractions being usually reckoned in *sous* of 20 to the franc; and truly, 25 francs, 4 sous, 15·8 centimes. It is commonly 25 francs, and 6, 7, and 8 sous, and 1 sous is taken by the broker from the published rate.

In 128 years, from 1689 to 1816, the gold coinage was 100½ millions, and the silver 13 millions, of which the first 58 of George III., included 74½ gold (much recoined) and 4½ silver. George I. and II., in 46 years, coined but 20 millions of gold, and £537,405 of silver.

There was coined in the entire reign of George III. in gold £71,639,213, and in silver £4,306,120.

The gold coinage averaged, in 20 years of Bank suspension, only ½ a million per annum, and the silver nothing.

The gold and silver coined in England, from 1790 to 1833, was 84 millions, of which 75 were gold and 9 silver. In 1821, the gold coined was 9½ millions of pounds sterling, and the silver £434,686.

The gold coined in 1834 was £1,292,000, and of silver £432,775, copper £3,136. That is, 27,650 lbs. of gold, 131,144 of silver, and 14 tons of copper.

In 1836, France coined 43½ millions of francs in silver, and 5 millions in gold. The first chiefly at Rouen, Paris, Lille, and Strasburg. The gold at Paris.

The present circulation of specie, in France, is estimated by French authorities at 3583 millions of francs, or 150 millions sterling, and the great abundance in circulation warrants the assertion.

In 1800 and 1821, gold bullion was £3 17*s.* 10½*d.* per ounce; but, in 1813, it rose to £5 1*s.*; and, in 1814, to £5 4*s.*; in 1815, to £5 11*s.*, by which the currency was depreciated 33 per cent.—*Kelly's Cambist.*

In 500 years our silver coinage has been reduced in value as 99 to 32, and gold as 3·5 to 1. In France and Spain the reduction of silver coinage has been as 17 to 1.

The chief GOLD COINS *of nations are in Sterling value as under :—*

	£	s.	d.
Austrian Sovereign ..	0	13	10·92
——— Ducat	0	9	4·58
Algiers Sequin	0	6	11
Belgian Sovereign	0	13	9½
Berne Ducat	0	8	1·48
Bavarian Carolin	1	0	4½
Cologne Ducat	0	9	3·7
——— Mark	2	0	0
Denmark Christian ..	0	16	7½
Egyptian Sequin	0	5	4½
East India Mohur	1	13	4
——— Rupee (Madras)	1	9	2·42
——— Star Pagoda ..	0	7	4·77
——— Japan Kopang ..	1	3	9·65
France, Louis	0	19	10·71
——— Napoleon	0	15	10·5
Geneva Pistole	0	14	1·9
Genoa Doppia	0	16	6·36
Hamburgh Ducat	0	9	4·35
Hanover George	0	16	4·66
Holland Ryder	1	4	9·75
——— Ducat	0	9	5½
Japan, New Kopang ..	1	5	11½
Milan, Sequin	0	9	4·98
——— Sovereign	1	7	10½
——— Doppia	0	15	7·74
Maltese Double Louis ..	1	18	2½
Naples Oncetta	0	10	3·4
Netherlands, 10-florin piece	0	16	5·93
Persian Rupee	1	9	2½
Piedmont Pistole .. .	1	2	2·75
——— Carlino	5	12	3·33
Poland, Ducat	0	9	4·34
Portugal, Joanese (6400 Rees)	1	15	11·98
——— Crusado (480 Rees)	0	2	7·43
Prussia, Frederic	0	16	6½
Rome, Pistole . .	0	13	8½
——— Sequin	0	9	4½
Russia, Ducat	0	9	2½
——— Imperial	2	1	7
Saxony, Ducat	0	9	4·34
Sicily, Ounce	0	10	10½
Spain, Pistole	0	15	11·35
Sweden, Ducat	0	9	3½
Switzerland, Pistole ..	0	18	8·91
Turkey, Sequin	0	6	11
Tuscany, Sequin . ..	0	9	6½
United States, Eagle ..	2	3	10½

SILVER COINS *of all nations, valued in pure Silver.*

	£	s.	d.
Austria, Rix Dollar ..	0	4	2
——— 20 Creutzer ..	0	0	8½
Bavaria, Crown	0	4	5½
——— Florin	0	1	8½
Belgian Crown	0	4	5½
Cologne, Rix Dollar ..	0	4	1·2
Denmark, 4 Marks .	0	3	0·04

Denmark, Rix Dollar ..	0	4	6
——— 24 Skillings ..	0	0	9·62
East Indies, Sicca Rupee ..	0	2	0·54
France, 5 Francs	0	3	11¼
——— Franc	0	0	9¾
Geneva, 21 Sous	0	0	7·65
——— 12 Florins	0	4	8·41
Genoa, Double Madonina ..	0	1	4·22
Hamburgh, Rix Dollar ..	0	4	7
——— 8 Schillings ..	0	0	6·99
Holland, 3 Florins ..	0	5	2·33
——— Guilder	0	1	8·49
——— 12 Stiver	0	1	0·90
——— 50 Stiver	0	4	3·77
Lubec, Rix Dollar	0	4	6
Milan, Scuro	0	3	8·62
——— Lira	0	0	7·37
Naples, 10 Carlini	0	3	5·20
Netherlands, Florin ..	0	1	8·72
Poland, Florin	0	0	11·72
Portugal, Crusado	0	2	4·67
——— Testoon	0	0	5·93
Prussia, Rix Dollar (30 Groschen)	0	2	11¼
Rome, Scudo	0	4	3·73
——— Testone	0	0	5·92
Russia, Ruble	0	3	2¼
——— Polten	0	1	7·06
——— 10 Copick	0	0	3·95
Saxony, Rix Dollar ..	0	4	1½
——— Thaler	0	0	5·87
Sierra Leone, Macuta ..	0	0	4·53
Spain, Dollar	0	4	3·79
——— Real	0	0	5
Sweden, Rix Dollar ..	0	4	6
——— 8 Skillings ..	0	0	8·9
Switzerland, 40 Batzen ..	0	4	9·18
——— 5 Batzen ..	0	0	6·88
Turkey, Piastre	0	0	9·45
——— Beshlie	0	3	2·54
United States, Dollar ..	0	4	3½
——— Dime, 1-10th	0	0	5·71
Venice, Ducat . ..	0	3	3·21
——— Lira	0	0	2·44

The British pound sterling is 24 francs 74·188 centimes of France; 11 gulden and 58·858 cents of Belgium, 4 dollars 44·44 cents of the United States, 74112·725 rees of Portugal; 9 florins, 31 kr., 3·24 pf., of Austria; 6 thaler, 20 silver groschen, and 1·601 pf. of Prussia; 92 reals, 23 maravidis, and 2·456 dineros of Spain; 4 scudi, 6 naoli, and 2 bajocchi of Rome, and 36 piastres, 8·585 paras of Turkey.

Our new silver coins are of less value than the old coinage. Thus, the crown is but 4s. 8·36d., and the shilling but 11·27d. in weight of pure silver.

The Cologne mark is 3609 grains.

The English mark is the troy pound, 5760 grains.

The French mark is the kilogramme, 5,434 grains.

The Spanish mark is 3550·5.

The Russian mark 6318·5,

The Turkish cheque 4957 grains

Sixty Cologne, Prussian, and Hambro' marks are equal to 451 ozs. of standard English silver. 80 Amsterdam marks are 633 troy ozs. 5 Spanish marks are 37 ozs. troy. 8 Portugal marks are 59 ozs. 19 marks of fine silver of Amsterdam are 164 ozs. 34 marks of Hamburgh ducats are 273 ozs. 8 marks fine silver of Hamburgh are 65 ozs. 111 ozs. of dollars are 107 ozs. and 48 ozs. are 43 of fine silver. 61 ozs. poids de marc 60 ozs. of standard silver. 31·1 grammes are 1 oz. 1000 Spanish dollars, or pieces of eight, *i. e.* 866 ozs., are 835 ozs. of standard silver, and 1000 doubloons, *i. e.* 868 ozs., are 853 ozs. of our silver.

In the United States, the dollar (whose par is 4s. 6d. sterling, or 5 francs, 40 centimes) is divided into 10 dimes, and each dime into 10 cents. The 100th of the dollar is a cent. and the 1000th a mill.

The dollar, in the northern states, is 6s. currency. In New York and North Carolina 8s. In New Jersey, Pennsylvania, &c. 7s. 6d.; and in South Carolina and Georgia 4s. 8d. A golden eagle is 10 dollars, or sterling £2 3s. 8d. Dollars are 4s. 3½d. sterling, and cents are 208 grains of copper, the hundredth of a dollar. A bit is the tenth of a dollar, and a pistareen is 2 bits.

Proportions of the Coin of various Nations to an American Dollar, its cents and thousandths:—

	D.	C.	M.		In Thousandths
A shilling..........	0	22	2	..	222
A crown	1	9	0	..	1,900
A sovereign, or a pound	4	44	0	..	4,440
A guinea	4	88	7	..	4,887
A franc	0	18	7·5	..	187·5
A livre tournois....	0	18	5	..	185
A marc banco......	0	33	3	..	333
A florin, or guilder	0	40	0	..	400
A pistareen........	0	16	0	..	160
A rupee	0	50	0	..	500
A Danish rix-dollar	1	0	0	..	1,000
A Spanish	1	0	0	..	1,000
A ruble............	1	0	0	..	1,000
A Swedish rix-dol.	1	4	0	..	1,400
A milrea	1	24	0	..	1,240
A Chinese tael......	1	48	0	..	1,480
A pagoda	1	84	0	..	1,840
A Spanish pistole ..	3	77	8	..	3,778
A moidore	8	0	8	..	8,008
A doubloon	14	83	3	..	14,833
A johannas	18	0	0	..	18,000

By means of the last column, any coins may be compared in a moment; by multiplying the number of thousands in any one, and dividing by the other. Thus, 35 shillings × 222 = 7770, which is 7 dollars and 77 cents or rubles, or rix-dollars; or divided by 187·5, is 42 francs and 82·5 cents; and so with the rest.

The relations of the American dollar to the English gold sovereign has been changed by Act of Congress, and a sovereign declared equal to 4 dollars, 84 centimes, instead of 4 dollars, 44 centimes.

Dollars, in England, are estimated at 4s. 6d. on account, but their real value is 4s. 1½d., the pound sterling being 4·83 dollars, and the par of exchange 109$\frac{2}{9}$. When the exchange is 105, the dollar is 4s. 3½d., when 114, only 3s. 11½d.

500 paras are a Spanish dollar, *i. e.* about half-a-farthing. Labourers get 20 a day.

In the West Indies, the American dollar, taken at 4*s.* 4*d.*, is 10*s.* or 15*s.* currency.

Currency in the West Indies is imaginary money, which varies against sterling from 40 to 100 per cent. In consequence, the dollar in Jamaica currency is 6*s.* 8*d.*, at Barbadoes 6*s.* 3*d.*, and at other islands 8*s.* 3*d.* and 9*s.* The doubloon at Jamaica, currency being £140 to £100, is £5—pistole £1 5*s.*, joe £5 10*s.*, guinea £1 12*s.* 6*d.*; bits, or reals, are 7½*d.*

Chinese money consists of silver and copper. Gold is a mere article of traffic, which passes by weight. Copper is the only coin, in pieces about four-fifths of a penny, called tcheng. The current interest of money is from 12 to 18 per cent. The only real coin is the tungtseen, or cash, the rest are imaginary.

10 cash one candareen.
10 candareens one mace.
10 mace one tael, or 6*s.* 9*d.* English.

At Canton, 1000 or 750 cash are 1 tael, about 6*s.* 8*d.* English. The tael is cast 3 of copper and 2 of lead.

At Calcutta, a rupee is 1*s.* 11¾*d.* A sicca rupee 2*s.* 0¾*d.*, and a gold mohur, 15 rupees, is £1 13*s* 2½*d.*, gold being £3 17*s.* 10½*d.* and silver 5*s.* 2*d.* per oz. The current rupee is 2*s.*, or ten to the pound sterling. A lac, 100,000, and a crore 10,000,000. The rupee is 16 annas, and the anna 12 pice; and in cowries, 2560 are a rupee.

The Bombay rupee is 2*s.* 3*d.* A maund, or 40 seers, is 28 lbs. and a thath 18 inches.

A star pagoda is 7*s.* 5½*d.* passing at 3½ rupees. The Arcot rupee is 1*s.* 11¼*d.* of 16 annas, or 192 pice. The gold rupee is £1 9*s.* 2½*d.*

99 several coins are more or less current in Hindostan.

A sum in Indian money is expressed in lacs of 100,000 rupees at 2*s.* 3*d.* (£11,250); thus, 5·38,220 means 5 lacs and 38,220 rupees.

A Turkish para is the 600th of a dollar. A piastre is 40 paras, the 15th of a dollar. A Russian ruble, or manet, is 3-4ths of a dollar. The Persian real is 0·35 of a dollar, and the gold toman is 3 dollars.

5000 Dutch florins are exactly equal to 10,582 French francs, and 26 florins are equal to 55 francs.

When the exchange is 25, then 100 francs are £4 sterling; when 26, then 100 francs are £3 16*s.* 11*d.*

Irish money of account is taken 12-13ths British, or as 48 to 52. 8¾*d.* or 35 farthings, Irish, is therefore 8¼*d.* British. 3*d* Irish is 2¾*d.* British, 6*d.* is 5½*d.*, 10*d.* is 9¼*d.*, and 11*d.* is 10¼*d.*, per 6th George IV. cap. 79.

Cowries are small shells, found at the Maldives and near Angola, which are the small change in India and Africa. At Boosa, and in Africa, 5000 pass for a pound.

In 1302 the silver penny, called a sterling, was ordered to weigh 32 grains of dried wheat, and 24 pennies to be an ounce of silver. An ounce is now divided into 66 pennies; so that money is in the ratio of 12 to 33, and prices as 1 to 6; or combined, as 1 to 15 nearly.

The term *Sterling*, is a corruption of *Easterling*.

300,000 gold leaves is an inch. 170,000 silver leaves is an inch. Their specific gravity is as 193 to 105.

Florins were first coined at Florence; and guilders were silver *gilt*.

The first shillings were coined by Henry VII. and were called testoons, or *testers*. Half-crowns, six-pences, and three-pences were coined by Edward VI.

One-third of our gold is supposed to be exported, one-fourth melted for manufacturers, and one-third hoarded, leaving one-twelfth for currency.

While a government enjoys public credit, its obligations are equivalent to currency, and in this manner many millions of the public debt of England have served to foster speculations. Parties lend and get interest, without diminishing their facilities.

Jewellers' gold and silver is but ¼ the alloy, or only 18 carats fine.

The mark of the Goldsmith's Company is by letters, from A to U, which began in 1796; so that, in 1837, it was U.

The Bullion Committee, of 1810, stated, that, at the price of gold, a guinea was then worth 23*s.*; and that this caused the foreign exchanges to be from 15 to 20 per cent. against England. They estimated country bank-notes at above 20 millions; and the Bank of England notes were then 21 millions; the gold, as coined, was £3 17*s.* 10½*d.* per ounce, at the Mint price; but melted, the market-price per ounce was £4 12*s.*

South America raised, from 1790 to 1810, and 1810 to 1830, 7½ and 6 millions of gold, and 115 and 54 millions of silver.

Mexico, in 1829, coined 11,100,968 dollars in silver, and 686,168 in gold, and exported 13 millions. Coquimbo yields 750,000 dollars in gold and silver. Mexico, for 22 years, has yielded about 10 millions; and, from 1790 to 1812, it was 24 millions. Potosi fell off from 4 to 1 million.

From 1690 to 1821 inclusive, the bullion furnished by the Mexican mines amounted, in round numbers, to about four hundred millions of pounds sterling, of which the gold was somewhat more than one-twentieth.

The Bullion Committee of the House of Commons, in 1810, computed the whole annual supply of bullion, at that time, at eight millions sterling for European use, one-third of which is used for manufactures.

In eagles, half-eagles, dollars, half-dollars, and cents, the United States government coined, in 1833, in amount, 3¾ millions worth of dollars. Of the gold, 9-10ths came from Carolina, and other mines in the States, which produce per annum 1½ million dollars worth.

A pound sterling, if paid in gold, is worth four dollars fifty-six cents, and ·572 of a cent. If paid in silver, four dollars thirty-four cents, and 0·894.

The power of coinage, conceded to sovereigns, has been in all ages a fertile means of robbing the people, by varying the alloy,

and substituting baser metals, and increasing and lowering the currency.

The marc of silver, in the reign of Francis I., was 13 francs 17 cents, and under the restored monarchy, it is 55 francs 06 cents. The setier of wheat, in the same, was 2 francs 80 cents, and 33 francs 38 cents.

Napoleon, amidst the wars into which he was forced by foreign cabinets, was the greatest improver of Numismatics. His coins and medals, under the direction of Denon, will be the wonder of all ages.

A Numismatic Society has been founded in London, and its valuable labours prove that coinage in the East was much older than the claims of the Greeks.

The Russian mines, in the Urals, according to Marshall, yielded in ten late years 65,330 lbs. of gold, 412,246 of silver, and 6067 of platina from Serpentine rocks, and a platina coinage has been established.

The coin called the Mark was 13s. 4d. and the name mark-lubs is still retained in Denmark, &c. as money of account.

A sou is 5 grammes of copper, and a franc is 5 grammes of silver, with 1-10th of copper.

Fabricators of base money make pieces at all prices, to meet the various avarice of vendors. They have qualities of 40, 60, or 80 shillings the pound.

Silver was first coined by Phidon, king of Argos, about 860, the epoch of the building of Carthage, and about 140 years after the building of Solomon's temple.

The most ancient Jewish coins represented a pot of manna on one side, and Aaron's blossoming-rod on the other; the inscriptions in Samaritan.

The coins mentioned in the New Testament were the Roman denarius, value $7\frac{1}{2}d.$; the as, $3\frac{1}{10}d.$; and the assarium, a farthing or mite.

Jewish skekels were 1s. 7d. A talent was 3000 shekels, or £342 3s. 9d. And a talent of gold £5475. Six Greek oboli were 6s. 7d. The drachma was 7s. 3d. The stater daricus was £1 12s. $3\frac{1}{2}d.$ And the statur aureus 16s. $1\frac{1}{2}d.$

The Egyptian talent was $86\frac{1}{4}$ lbs. The mina was in 16 ozs., and agreed with our lb. The litra was 6886 grains, and in 12 ozs.

A pound of gold was, by the Romans, divided into a coin called Aureus, of 40, 45, and 72 to the pound. A pound of silver into 100 denarii. The sestertius was nearly 2d., the denarius $7\frac{1}{2}d.$, the aureus $16\cdot 1\frac{1}{2}$.

The Egyptians did not coin till the accession of the Ptolemies, nor the Jews till the age of the Maccabees. The Persian daries are two centuries old. The Britons coined before the Roman invasion, and they had also bracelet rings, which passed as money in all ancient nations.

The most ancient known coins are of the fifth century B. C. and are Macedonian; but others are believed to be more ancient. After that date they illustrate history, but not earlier. They are of gold, silver, copper, or brass. Few give dates, and, therefore, they are more curious as relics than useful.

On the Roman coins the date is the name of the consul or emperor; and among the Greeks the name of the Archon, or king.

The Roman As was 10 for 31 pence—the sestercius 1s. $3\frac{3}{4}d.$—the aureus £1 4s. $3\frac{3}{4}d.$ A talent of gold was worth £54.75, and a talent of silver £342 3s. 9d.

The drachma of the Greeks was a silver coin of the eighth of an ounce, worth 9d. The sestrice of the Romans was about 2d., and was of silver and brass, or brass only, marked J. J. S. A talent among the Greeks was 1000 drachmas.

Among the Greeks, an obolus was three half-pence—a drachma, 9d.—a mina, 3l. 15s. —a talent, 225l. The silver tetra drachm of Athens was as current before Christ as the Spanish dollar of our times.

In Greece, silver was to gold as 15 and 10 to 1; in Rome, as 12 and 7 to 1; till Columbus, as 12 and 10 to 1; and in modern Europe, as 17 and 14 to 1. The mines produce 52 lbs. of silver for 1 of gold.

Roman coins are found on the Malabar coast.

MEASURES OF TIME AND CHRONOLOGY.

(*See also* Ancient and Modern History.)

Time, so important to man, has been without a definition. A second, a day, a year, &c. have been considered as independent of other circumstances. We now know, however, that a second measured by the swing of a thirty-nine inch pendulum is identical with that motion, and that the motion itself is a mere deflection of the combined motions of the earth. We know, too, that a day is the motion of the rotation of the earth; and that a year is the motion of the earth's revolution round the sun. So also we know that all other times are *identical* with relative motions of the system in which we are involved. With this better knowledge, we might even dispense with the word time, and substitute known motions for its divisions.

Since the motions of the earth generate days and nights, seasons and years, and all motion on the earth, so those motions include all events on the earth, whether national or personal; and all events and incidents begin and end in the finite motions of the earth, at once, as cause, means, beginning, and end.

Our most refined sensations of what is called time, exist in vibrations of musical strings, of which tones may be discriminated up to 7500 vibrations in a second, or in the swing of a second's pendulum. The beats of a second's watch are 5 in a second. And healthy pulsations are 10 or 11 in every 9 seconds. The succession of ideas in a second has not been determined, but it is these, and their varied intensity which associate us with natural motions, or their denominations in what is called Time.

The same motions produce feebler impressions, by continued repetition; hence time, the ideal of the motions, appears to shorten as life advances. It also shortens by em-

ployments, which exclude the regular succession of its sensations; and it appears to lengthen when no other objects create other sensations.

Besides the measures of time in its simple obvious motions, there are measures by complex motions called *Cycles*, and measures of progressing time, dated from certain events, called *Epochs*, or *Æras*. The invention of cycles, and the recognition of epochs constitute Chronology.

Epochs are to History like the Equator as to Latitude, and the First Meridian as to Longitude. Herodotus and Thucidydes were without both. The Jews, and, till Eratosthenes, in 194 B.C., the Greeks reckoned by generations backward. The Olympic games were revived in 884, but their epoch was taken from 776, and used till 440 of our era, when the indiction of 15 years was substituted. The Christian era was first used at Rome, in 527; adopted in France, in 750; in Spain, in 1340; and in Portugal, in 1410.

The birth of Christ was, in fact, four years earlier, that is, in 1838, really 1842 since the birth of Christ. To avoid dates *before* and *after*, the Julian period was adopted by 28 solar × 19 lunar × 15 indiction = 7980, and also the Louisian of double, or 15760. Others seek to go back to the epoch of Adam, but there are 300 different determinations varying between 6984 to 3483 B.C. owing to different constructions of the Biblical text.

Chronologists distinguish dates and epochs by letters; as A. M. Anno Mundi, A. C. Ante Christi, or B. C. before Christ, and A. D. Anno Domini, or A. C. after Christ. A. U. C. *ab urbe conditor*, from the building of Rome, 753 B. C. Greek epochs are marked *Olym.* meaning the number of the Olympiad, which began 776, in periods of four years, beginning from our July, or their Hecatombeon. Hence, our 0 of Christ answers to the 4th of the 194th Olympiad.

Relation of other Eras to 1838.

Roman year	2591
Year of World (Constantinopolitan)	7346
Ditto (Alexandrian)	7330
Ditto (Jewish account)	5598
Era of Nabonasser	2586
Egyptian	2584
Julian Period	6551
Dioclesian, or of Martyrs	1554
Seleucides, or Grecian	2149
Death of Alexander	2161
Era of Tyre	1962
Cæsarian of Antioch (Greek) ..	1886
Ditto (Syrian) ..	1885
Era of Abraham	3853
Spanish, or of the Cæsars	1876
Persian Era of Yezdegird III. (Parsee)	1207
Armenian common year	1287
Hegira	1253
Cali yug	4939
Salivahana	1760
Vikramaditya	1894
Bedgalee	1244
Fuslee (Bengal account)	1245
Ditto (Telinga account)	1247
Era of Collam, 4th month of ..	1013
Grahaparivrithi, 62d year of 21st cycle	1824
Brihuspotee 43d year of 84th cycle ..	5083
Ditto 32d year of 83d cycle ..	5012
Chinese 11th month of Ting yew, 71st	4260

As the Earth moves in its orbit round the Sun, from East to West, and in its daily rotation moves from West to East, it arrives at a Star, fixed as to the Earth and Sun, before it arrives again at the Sun. The difference is 3 minutes, 55·91 seconds, that is, it re-arrives at the same Star in 23 hours, 56 minutes, 4·09 seconds, while the return to the Sun is called an even 24 hours. It is, itself, a proof of the two motions, which motions also make a pendulum swing 86,400 times in the return of the same place to the Sun's centre, and only 86164·09 in the return to the same fixed Star.

Our legal day is 12 hours before noon, and 12 hours after.

The *astronomical* day is the time which elapses from the sun's being on *the meridian* of a place till his return, divided into twenty-four hours of sixty minutes. Astronomers count twelve hours till midnight, P. M. or after; and twelve hours from midnight till noon A. M. or before. Their day after twelve at night is a day later than *civil reckoning*, which begins the new day from twelve at night.

Law proceedings preserve the Roman names of the days, as *Dies Solus*, *Lunæ*, *Martis*, *Mercurii*, *Jovis*, *Veneris*, and *Saturni*, derived from the ancient deities. But, in ordinary use, the names are derived from the Gothic or Teutonic deities, the *Sun*, *Moon*, *Tuesco*, *Woden*, *Thor*, *Friga*, and *Saturn*.

If the planes of the equator and ecliptic coincided; and if the earth moved with equal pace in its orbit, the solar day would constantly exceed the sidereal day by 3 min. 55·91 sec. of time. But the obliquity of the ecliptic varies the equatorial angle of the degrees; and the *mean* motion (59′ 10″·7 of a degree) in a day, is when nearest or in *perihelion*, 61′ 9″·9, and when farthest or in *aphelion* but 57′ 10″·7, so the mean time for 59′ 10″·7, (or 23 hours, 50 minutes, 4·09 seconds) is more or less.

As to those motions, it accords only for April 16, June 16, Sept. 1, and December 25; but, on November 1, both causes concur to make the difference 16′ 16″.

The mean excess, 3 min. 55·9, is equal to a day, or a silent revolution as to the Stars, in a year, by which the earth gains a quantity equal its own circumference in the orbit. The Stars appear to go back in the equator, while the orbit itself is carried onward as to the Sun. The consequence is the falling back of the nodes, called the *precession of the equinoxes*; and the simultaneous advance of the orbit in space as to the Stars, called the *progression of the apsides*.

In the *earth's* rotation, 15 seconds of a degree is equal to 1 second of time, but in the *orbit* there are 24·35 seconds of time to every second of a degree in the ecliptic, *i. e.* 31558214 seconds in the sidereal year.

The combination of both causes produces a table of equation of time, by which true clocks ought to be kept faster or slower than the meridian sun, or a sun-dial, called *mean apparent* time, and the other true or mean time. A clock and a sun-dial vary as follows:—

January	1	4	
	3	5	
	5	6	Clock faster than the Sun.
	7	7	
	9	8	
	12	9	
	15	10	
	18	11	
	21	12	
	25	13	
	31	14	
February	10	15	
	21	14	
	27	13	
March	4	12	
	8	11	
	12	10	
	15	9	Add to app. time.
	19	8	
	22	7	
	25	6	
	28	5	
April	1	4	
	4	3	
	7	2	
	11	1	
	15	0	
	19	1	
	24	2	Clock slower.
	30	3	
May	13	4	
	29	3	
June	5	2	
	10	1	
	15	0	
	20	1	Clock faster.
	25	2	
	29	3	
July	5	4	
	11	5	
	28	6	

August	9	5	Clock faster.
	15	4	
	20	3	
	24	2	
	28	1	
	31	0	
September	3	1	
	6	2	
	9	3	Clock slower than the Sun.
	12	4	
	15	5	
	18	6	
	21	7	
	24	8	
	27	9	
	30	10	
October	3	11	
	6	12	
	10	13	
	14	14	
	19	15	
	27	16	
Novem.	15	15	Subtract from app. time.
	20	14	
	24	13	
	27	12	
	30	11	
Decem.	2	10	
	5	9	
	7	8	
	9	7	
	11	6	
	13	5	
	16	4	
	18	3	
	20	2	
	22	1	
	24	0	
	26	1	Fast.
	28	2	
	30	3	

The greatest difference of mean and apparent time is on November 1 and 2, *i. e.* 16 min. 17 sec., and when the Sun is on the meridian the clock should then be earlier, or 11 hours, 43 min. 43 sec. On the 10th and 11th of February, it is 14 min. 35 sec. in addition, and at noon the clock should be 14 min. 35 sec. after 12.

Clock before the Sun, means that then the clock should be made more than the Sun-dial indicates. Clock after, &c. the contrary.

The synodical lunar month of her departure from the Sun's centre to the return, or from full to full, is 29 days, 12 hours, 44 min. 12 sec.—Decimal 29 5305887 days.

The Sun and Moon return to the same relative positions every 223 lunations; or, according to the ancient Chaldeans, in 6585 days, 8 hours. Our modern tables make it 17·29″ less.

The months, or lunar periods are Roman and September, October, November, and December, were so called when the Roman year began in March.

The *Tropical year* is 365 days, 5 49′, 49·7″. Decimal 365 242235, log. 2 562581.

The *Sidereal year* is 365 days, 6 9′, 9 6. Decimal 365·25636, log. 2 562593.

The *Anomalistic year*, or perfected orbit, is 365 days, 6 13′, 49 3″. Decimal 365 256603, log. 2 562603.

There are thus three years to one earth, but the mean velocities are uniform, and the times as the spaces.

The Tropical year in seconds of time is 31556927 7. The Sidereal 31558107 6, log. 7·499110. The Anomalistic is 31558427 3 Differences S — T = 1219 9. A — S = 279 7. A — T = 1499 6.

The seconds of space in 360 degrees are 1,296,000, log. 6 112606. The difference in space S — T = 50·088″. A — S 11·496″. A — T 61·584″.

The ratio of the seconds of time in the mean Sidereal year is log. 1·386504 or 24 3501 seconds of time to 1 of space.

The product of the sine of the obliquity of the ecliptic, the sine of the complement and the radius, is equal to log. 2·562565, the days and parts of days in a year. Decimal 365·22841678, or 365 days, 5·29′, 55 2″. The 20′ 19·9″ created by the tropical acceleration of the Sidereal year, makes 365 days, 5·49′, 5·2″, the same as the Tropical year.

The Tropical and Sidereal years are the same, and the Tropic is merely an anticipated solar mark before the Sidereal year is completed. The Anomalistic year is an advance of the orbit as part of the solar system in space, and its excess over the Sidereal year is the stellar measure of the annual advance of the whole system.

Astronomers have not agreed about the exact length of the year:—

Lalande made the Solar, or Tropical year, *above* 365 days	5 h. 48′ 35″·3
Von Zach	5 h. 48′ 48″·016
Observatory, Greenwich	5 h. 48′ 49″·7

The year is 365 24224 solar days, but our Leap years take 365·25, so that we gain the 0·00776 per annum, or a day in 128 years.

The Sun is 7 days, 16 hours, 51 minutes, longer in the northern signs than in the southern.

Northern signs.

From the spring to the summer solstice is ..	92 d. 21 h. 45 m.
From the summer to the autumnal equinox ..	93 d. 13 h. 35 m.

Southern signs.

From the autumnal to the winter solstice ..	89 d. 16 h. 47 m.
From the winter to the spring equinox	90 d. 1 h. 42 m.

As the year used to be reckoned 365 days, 6 hours, and the true year is but 365 days, 5 hours, 48′, 48″, the 11′, 12″, in 1752, became 11 days too much, and the 2d of Sept. 1752, was called the 13th, and the reckoning and the true motion made to agree. At Rome this was effected in 1582 when the

vernal equinox fell on the 11th instead of 21st, and 10 days were dropped. Three Leap years are omitted in 400 years, but 109 Leap years in 450 years would be exact.

Leap year is the year which divides evenly by four; but the year 1900 will not be Leap year, to make up for the odd minutes gained between the astronomical and computed year, as 365 days. In 400 years 97 are Leap.

The Romans added the day in Leap year on the sixth of the calends of March, making two *sixths*, or *bis sextus*, and hence the word Bis-extile.

The English, till 1752, began the year at the vernal equinox. Thence, to make dates agree with those of other nations, between January and Lady-day, our writers used to put two dates, as Feb. 10, $\frac{1708}{1709}$. The bottom date being that from Jan. 1, and the upper that from the previous Lady-day.

Quarter-days, in civil reckoning, are March 25, June 24, Sept. 29, and Dec. 25, festivals of the Catholic Church.

PERPETUAL ALMANAC TO ASCERTAIN THE DAY OF THE WEEK FOR ANY DAY OF THE MONTH WITHIN THE NINETEENTH CENTURY.

COMMON YEARS.											31 Jan.	28 Feb.	31 Mar.	30 April.	31 May.	30 June.	31 July.	31 Aug.	30 Sept.	31 Oct.	30 Nov.	31 Dec.
1801	1807	1818	1829	1835	1846	1857	1863	1874	1885	1891	4	7	7	3	5	1	3	6	2	4	7	2
1802	1813	1819	1830	1841	1847	1858	1869	1875	1886	1897	5	1	1	4	6	2	4	7	3	5	1	3
1803	1814	1825	1831	1842	1853	1859	1870	1881	1887	1898	6	2	2	5	7	3	5	1	4	6	2	4
1805	1811	1822	1833	1839	1850	1861	1867	1878	1889	1895	2	5	5	1	3	6	1	4	7	2	5	7
1806	1817	1823	1834	1845	1851	1862	1873	1879	1890		3	6	6	2	4	7	2	5	1	3	6	1
1809	1815	1826	1837	1843	1854	1865	1871	1882	1893	1899	7	3	3	6	1	4	6	2	5	7	3	5
1810	1821	1827	1838	1849	1855	1866	1877	1883	1894	1900	1	4	4	7	2	5	7	3	6	1	4	6

LEAP YEARS.				31	29	31	30	31	30	31	31	30	31	30	31
1804	1832	1860	1888	7	3	4	7	2	5	7	3	6	1	4	6
1808	1836	1864	1892	5	1	2	5	7	3	5	1	4	6	2	4
1812	1840	1868	1896	3	6	7	3	5	1	3	6	2	4	7	2
1816	1844	1872		1	4	5	1	3	6	1	4	7	2	5	7
1820	1848	1876		6	2	3	6	1	4	6	2	5	7	3	5
1824	1852	1880		4	7	1	4	6	2	4	7	3	5	1	3
1828	1856	1884		2	5	6	2	4	7	2	5	1	3	6	1

Example:—To know what day of the week June 12 will be on in 1835, in the table of years find 1835, and in the line under June, you are directed to col. 1, in which June 12 appears to be on Friday, for add 7 to the 5th, or first Friday we get the 12th, and if the 19th we add 14. Subtract from the given day of the month 7, 14, 21, or 28, and you get the day of the week. Thus in col. 4, opposite 1837, June 24 is on a Saturday, for 21 subtracted leaves 3.

1		2		3		4		5		6		7	
Monday	1	Tuesday	1	Wednes.	1	Thursday	1	Friday	1	Saturday	1	SUNDAY	1
Tuesday	2	Wednes.	2	Thursday	2	Friday	2	Saturday	2	SUNDAY	2	Monday	2
Wednes.	3	Thursday	3	Friday	3	Saturday	3	SUNDAY	3	Monday	3	Tuesday	3
Thursday	4	Friday	4	Saturday	4	SUNDAY	4	Monday	4	Tuesday	4	Wednes.	4
Friday	5	Saturday	5	SUNDAY	5	Monday	5	Tuesday	5	Wednes.	5	Thursday	5
Saturday	6	SUNDAY	6	Monday	6	Tuesday	6	Wednes.	6	Thursday	6	Friday	6
SUNDAY	7	Monday	7	Tuesday	7	Wednes.	7	Thursday	7	Friday	7	Saturday	7

Every year is distinguished by its Dominical Letter, A to G, and in every Leap year there are two Dominical Letters, one to the end of February, and the other the letter preceding.

To find, for any year, the Dominical Letter, 1. Divide the centuries by 4. 2. Take twice what remains from 6. 3. Add this last remainder to the odd years above the even centuries, and to the 4th part of these add year in even numbers. 4. Divide the sum by 7. 5. Subtract the remainder from 7, and this is the number of the Dominical or Sunday Letter. Thus 1836, by 4, gives no remainder; then $6 + 36 + 9 = 51$, which by 7, gives 2, and $7 - 2 = 5$, which from G is C, and being Leap year after Feb. 29, is B. And being third from A, the first Sunday is the 3d of January.

To find the *Golden Number*, or year of

the *Lunar Cycle*, add 1 to the date, and divide by 19, then the quotient is the number of cycles since Christ, and the remainder is the Golden Number.

The Dominical Letter, for 1838, is G, the Golden Number 15, the Epact 4.

Easter Day April 15. Whit-Sunday June 3.

The Cycle of the Sun is the 28 years before the days of the week return to the same days of the month. It is found by adding 9 to the date of the year, and dividing by 28; the quotient is the number of cycles, and the remainder is the number of the cycle.

The Epact is the moon's age on the 1st of January. A year is 12 moons and 11 days. To determine this from 1800 to 1900, subtract 1 from the Golden Number, found as above, multiply by 11, and divide by 30, and the remainder is the moon's age for January 1.

To find the moon's age on any day, add the epact of the year, the epact of the month, and the day of the month together; if less than 29½, it is the moon's age; if more, take 29½ from it. The epact of the month—0 for January, 2 for February, 1 for March, and 3, 4, &c. to 10 from April to December.

The Epact is the eleven days which the solar year exceeds twelve lunations.

The time of the moon's southing is four-fifths of an hour later every day from the last new moon.

Easter is the first Sunday after the first full moon that occurs after the 21st of March; to find it add 6 to the epact, and subtract from 50, or if the sum is above 30, subtract the remainder, and the difference is the day of the full moon, counting from after March 1; this is called the Easter limit, and Easter Sunday is the following Sunday. To fix the day of the month add 4 to the number of the Dominical Letter for the year, and subtract the sum from the Easter limit; then take this remainder from any multiple of 7 *greater* than the said remainder, and add the new remainder to the Easter limit, and the sum will be the day on which Easter Sunday falls in March, if less than 31, or in April, if more than 31.

Easter is a festival of Phœnician origin, called Estarte or Ashtaroth.

The Cycle of *Indiction* was 15, and began 3 B.C.

The three cycles, 19, 28, and 15, multiplied, produce 7980 changes, after which period, they return in the same order as before; and this is called the Julian period. The year 1 of Christ was 4714 of this compounded period.

The metonic cycle of 19 years is 1 hour, 29 minutes more than 235 lunations of 29 days, 12 hours, 44′, 2″, 48‴ *i. e.* 8 hours in 100 years, and a day in 300 years.

The year 1838 is the 6551 of the Julian period.

The Christian festivals appear to have been fixed astrologically. The feast of the Virgin Mary is on the day the Sun enters Aries that of John the Baptist on entering Cancer, that of Michael on entering Libra, and that of Jesus on entering Capricorn, these being the four cardinal points. St. Paul on entering Aquarius, Matthew on entering Pisces, Mark on entering Taurus, Corpus Christi on entering Gemini, St. James on entering Leo, St. Bartholomew on entering Virgo, Simon and Jude on entering Scorpio. The days correspond, allowing for the precession of the equinoxes.

Epiphany, or 12th Day, celebrates the arrival of the wise men of the East.

Plough Monday is the end of Christmas.

The Purification, or Candlemas, celebrates the Jewish ceremony of the presentation of the Mother of Jesus.

Quadragesima Sunday is the first Sunday in Lent, Septuagesima is the Sunday before, and Quinquagesima precedes.

Ash Wednesday is the day which commences the forty days of Lent, when for four days the Popes sprinkle ashes.

Lady-Day is the day of the Virgin's miraculous conception.

Palm Sunday celebrates Christ's entrance into Jerusalem.

Maunday Thursday, when kings give alms, &c. to the poor.

Good Friday celebrates the Crucifixion.

Easter Sunday the Resurrection.

Ascension-day, forty days after Easter Sunday.

Whit-Sunday is forty-nine days after Easter Sunday, also the day of Pentecost.

Trinity Sunday, next after Whit-Sunday.

Lammas was an ancient quarter-day, according with Whitsuntide, Martinmas, and Candlemas.

Michaelmas is a festival in honour of Michael, an angel much spoken of by magicians.

All Saints is a day of prayer for saints who have no special days.

Advent Sunday is that which is nearest to St. Andrew's day.

Christmas celebrates the birth of Christ.

St. Stephen's and the Holy Innocents celebrate the massacre of the first martyr and the children by Herod.

April is so called from Aperit, the Spring.

September, October, &c. were the 7th, 8th, &c. months of the year of Romulus.

Plough Monday was the feast of the plough, in honour of agriculture.

St. David's Day is March 1, St. Patrick's March 17, St. George's April 23, St. Andrew's Nov. 30, St. Deny's Oct. 9.

These and other days, to the number of 300, besides Sundays, used to be celebrated by the Catholic Church, and being identified with the customs of the nation, have been preserved in the Anglican Church.

Dionysius, a monk, introduced the Æra of Christ, in 527. It was not general till the 15th century.

The astronomical equinoxes are on the 21st of March and 21st of September, and the Sun is in the tropics on the 21st of December or June.

Christian nations assign thirty days to April, June, September, and November,

thirty-one to other months, and twenty-eight to February, making three hundred and sixty-five; but three hundred and sixty-six in leap-year, when February is twenty-nine.

The precession of the equinoxes is performed in 25868 years; and the revolution of the line of apsides in 20931. The precession of the equinoxes is per annum 50″·1005 or 1° 23′ 30″ in a century. The advance of the Apsides is 61″ 9177 per annum, or 1° 43′ 16″ in a century. One varies the declination of the perihelion and aphelion forces, and produces alternate accumulations of the seas in both hemispheres; and the other (the precession) varies the aspect of the heavens at the same periods of the year.

The Jews began the year in March, and the months were Nisan, Zif, Sivan, Tammuz, Ab, Elul, Tisri, Bul, Cislieu, Tebeth, Shebat, Adar. The Sabbath, or seventh day, is Saturday. The days and nights, from sun-rise and sun-set, were divided into twelve equal parts, or hours, 1, 2, 3, &c. The night-watches were three hours each, from sun-set to sun-rise. The months were lunar, or 30 and 29 days, and they introduced an extra month every two or three years. The day commences and ends at sun-set.

The Jewish months were alternately 29 and 30 days, and their year of twelve lunations 354 days. Their year commences with the vernal equinox. To recover the four days they intercalate a whole month after every two or three years, following their twelfth month, or Adar; and they call this extra month Ve-adar.

The Jewish day commences at six in the evening, or sun-set, and continues till the same hour on the following evening. Their civil year commences with the new moon near the vernal equinox, in the month called Tisri, of 30 days, corresponding with part of September and part of October.

The Jewish year 5599 commences Sep. 20, 1838.

The Ramadan commences November 18, 1838.

The ancients made convenient approximations, when they gave 12 moons, or months to the year, and when they divided the Zodiac into 12 signs of 30 degrees each. In moons, they lost nearly 11 days, and in 360 degrees they lost about 5¼ in every year. Hence the confusion of their dates, some reckoning by the equal period of days—others by moons, or weeks—and some by revolutions round the Sun. Inattention, often wilful, to the motions or measures of different nations, or authors, leads to most of the discrepancies of ancient authors in chronology.

The Roman *lustra* were periods of 5 years; and the Greek Olympiads periods of 4 years; and the first commenced in 776 B.C.

Italian days, from 1 to 24 hours, begin 24 at half an hour after Sun-set, and count 1 at 1½ hour after Sun-set. The Mahometans reckon 12 hours from Sun-set to Sun-rise, and so for the day, whatever be the length of either. The Chinese begin an hour before mid-night, and divide the rotation into 12 parts of 2 of our hours, and give a name to each division. The Hindoos divide the day into 4 watches, and each watch into *ghurees* of 24 minutes each, 60 of which make up the rotation of 1440 minutes.

The Hegira, or Flight, took place July 16, 622, and is the Mahomedan era. Their year is 12 lunar months, or 354 days, 8 hours, 48 minutes; and eleven days being lost, a year must be allowed every 33, to reconcile their dates with ours.

The Mahomedans, for 1830, began June 22; 1831, June 12; 1832, May 31; 1833, May 21; 1834, May 10; 1835, April 29; and, going back, will be in 1895 on June 22 again; and in another 65 years, or 1960, they will begin the year on June 26th.

Our year 1840 is the Hegira 1256, beginning March 5; our 1845 is 1261, on Jan. 10; and our 1850 is 1267, beginning Nov. 6; 1900 is 1318, on May 1. It falls back 11 or 12 days per annum.

The periodical month of the Turks and Arabs, or sidereal period of the Moon, is 27 days, 7 hours, 43′ 48″. The synodical month, or return to the conjunction of the Sun, is 29 days, 12 hours, 44′ 3″ 11 thirds.

The Jews still celebrate as fasts the day of the deaths of Moses, Miriam, Joshua, Elijah, Samuel, Aaron, Gedaliah, and Herod.

The Mahomedans celebrate the defeat at Vienna, the taking of Constantinople, and the birth of Mahomet.

The eastern nations, where the day varies little, reckon the day from sun-rise. Romans reckoned from midnight.

The Persians give names to every day in the month, just as we give them to days of the week.

Saturday, the seventh day, is, by the Arabs, called *Sabt*. And Monday is called Jama, in all the Eastern languages.

In the year 1000 A. C. the Arabs used the pendulum as a measure of time.

The Hindoos have been caricatured in their chronology, either by ignorance of European reporters, or by such misinformation as the Egyptian priests used to give the Greeks. They are profound astronomers, and have tables for calculating the Planets, or places, consisting of multiples of periods, exactly like our tables for the same purposes. Ignorance has converted these into records of past time, and the usual multiples of mean motions have been supposed to be thousands and millions of past years! Their longest astronomical period is the *maha-yug* of 4,320,000 years, as the least even multiple of even lunations and solar days; and it contains (if we get the figures right) 52,753,336 lunations and 1,577,917,828 days. They thus determine a mean lunation to be 29 days, 12 hours, 44′, 2″, 47‴, 36⁗, and the year to be 365 days, 5 hours, 31′, 31″, 24‴. But every intelligent reader will perceive that this is astronomy, not chronology; yet we are told the Hindoos claim millions of years! Their civil history does not go back above 2000 B.C. But their sciences, poetry

&c. are of much higher antiquity. Prose histories were a later invention. The Astronomers divide the maya-yug into the sabya-yug of 0·4. The treta of 0·3. The dwapa 0·2, and the cali-yug of 0·1, or 432,000 years, all of them approximate multiples; and this last is often quoted by ignorant ancient writers, as a real period of observation! It began in 3102 B. C.

It is, however, proper to state, that the priests claim a theological time of nearly 2000 millions of years since the beginning, and they say, that Brahma was 17 millions of years creating. They refer also to periodical deluges, such as the elliptical orbit and geology demand.

According to the Hindoos, 4944 years have elapsed since the commencement of the cali-yug, or present period of 432,000. The European reporters, also, describe it as an article of *Faith*, that Satyavrata lived through the first period of 1,728,000, fifty-five sovereigns in the next, 23,000 years each, twenty-nine in the next, nearly 30,000 each, and then thirty in 1000 years, or 33 each, called solar kings.

In India, a day is divided into 60 ghurries, a ghurry into 60 puls, a pul into 60 prans, and a pran into 10 tas, in 2·5ths of a second.

Chinese reckoning is lunar months, or 29 and 30 days alternately; every three years they add a 13th month to reconcile the motions of the Sun and Moon.

The difference between a solar and ancient lunar year was 10·8755 days.

The Chaldeans made the sidereal year 365 days, 6 hours, 14 minutes, or 1 minute, 49 seconds more than our present year; and the tropical year 365 days, 5 hours, 49 minutes, 30 seconds.

Hipparchus, in his measure of the tropical year, made 11·2″ more than at this time. The Brahmins made it 1 minute, 43 seconds more than now.

The Egyptian year began at the heliacal rising of Sirius, and being 365 days, they lost a year in 1460, and then called 1461, 1462.

The Chaldeans, Egyptians, and Jews, began their civil year from the autumnal equinox. The Persians, Greeks, Romans, from the vernal equinox.

The Olympic games were reckoned from the prætor Corœbus whose name had been first recorded, in 776. The games had been re-established 108 years previously. The Olympian date was continued till the fifth century A. C.

Newton reckons reigns at only 18 or 20 years, but modern history makes it 25; and he fixed the Argonautic expedition in 928, on data now exploded.

Ancient observations of eclipses verify many dates, and have been used to some advantage.

In computing the year of the Hegira, subtract 621 from the year A. D. and then add 0·03ths to the remainder.

The Ancients measured time by sun-dials and clepsydra. The latter founded the laws of the unequal flow or pressure of water. It appeared that if, in 12 hours, 144 inches in heighth of water flowed, the flow is 23 inches in the first hour, 21 in the second, 19 in the third, &c. to 1 inch only in the last or 12th hour. Hence, the height in each hour is inversely as the squares of the times, 1 in the 12th hour, 4, 9, 16, 25, 36, 121 and 144, in the commencement of the 1st hour. They also used sand glasses.

The Zodiac corresponds with the Egyptian seasons, 15,000 years ago.—*La Place.*

As the orbits of the planets complete their seasons their periods are taken to be their years; hence Mercury has nearly four years in ours, Venus two-thirds, Mars is nearly four times as long, Jupiter twelve times, Saturn thirty, Herschel eighty-three, and more distant planets longer.

HISTORICAL CHRONOLOGY.

The Roman years were A. U. C. that is, *ab urbe condita*, from April 21, 754, B. C. Year 10 months.

Greek Olympiads of 4 years began 776 B. C. Year 12 and 13 months. The first was Hecatombeon, and in years of 13, Poseideon was repeated.

The Romans dated by the indiction of 15 years, and extended it in their conquests.

Of the time, or motion, that has elapsed since the *Beginning* of the globe, we can have no approximate idea. Genesis speaks of it indefinitely, and the data afforded by rocks and fossils are vague; yet, till geology surprised us by its facts, historians had been so mystified that their opinions are worthless. Whether a million, or many million of years have elapsed since the coal formation, cannot be ascertained, and then below these are organized relics, whose production must have employed far more time.

The Hindoos first used cycles and epochs, then the Egyptians and Chinese. The Jews had none till after their return under Ezra. The Greeks had none till they counted by the series of the Olympic games, and the Babylonians none till they adopted the first year of Nabonaser. History without epochs to count from, is like mile-stones without a first standard.

The era of the cali-yug began 3101 B. C., and now commences in April.

The cycle of Brihuspotee, or Jupiter, is 60 years, and the 84th is now passing, so that it began before the time of the cali-yug, *i. e.* 3184, and every period has a name.

The Hindoos have two others, Vikramaditya in 56, and Saka in 76.

Taautus introduced at So, in 3160, the cycle called Sothic, of 1460 years, which includes the odd ¼ day ($4 \times 365 = 1460$.) The second expired about 240 B. C. and its return is called the Phœnix.

The Chinese cycle is 60 years, each 10th and 12th having a name. They are now in the 76th, which, therefore, commenced about 4550.

The era of the Seleucidæ, 311 B. C., of Alexander 223 B. C., and of the battle of Actium 31 B. C., of the Cæsars 38 B. C., of

Tyre 125, of Abraham 2016, and of Antioch 49, were also used by some early writers.

The Mexican era began in 1090 A. C. and their year was astronomical.

The Armenian era began 552 A. D. The French era began Sept. 22, 1792.

The Chaldean *Saros* was the lunar cycle of 18 years, 10 or 11 days, 7 hours, and 43 minutes.

The 46th year of the Julian calendar was the first of our era.

There is an uncertainty about the Epoch of the birth of Christ, and also whether he was crucified in the 15th, 16th, or 19th year of Tiberius. The early fathers assigned but one year to his public preaching, others two, but Eusebius made it three and a-half, and, if so, he lived till the 19th of Tiberius. The chronology was not inquired into till the sixth century, in the reign of Justinian.

The first year of the Christian Era began on the Jewish Sabbath, Saturday. The early Christians, till the era of the birth of Christ was estimated, dated from the accession of Diocletian in 284.

Our earliest records are the Jewish Scriptures, the Dynasties of Manetho, the Chinese Annals, and the Abstract of Sanchoniatho, by Eusebius, but the learned are divided into parties, when these are used as measures of past time.

We have in the Bible an accurate measure from Abraham to Joshua, and from Samuel to the Christian Æra. But mankind have not agreed about the period before Abraham, nor about the length of the interval from Joshua to Samuel. Manetho is thought to have confused his Dynasties. The Chinese Annals merit respect; but Sanchoniatho has no dates.

Josephus, Syncellus, Herodotus, and some other Greek and Roman writers, compiled with the advantage of authorities no longer in existence, but none of them had the advantage of the new lights, which the study of Geology has thrown on the age of the world.

The Epoch of Adam is that to which chronology usually aspires. The Vulgate fixes it at 4004 years B. C., which is adopted by the Romish church. The Samaritan Pentateuch makes it 4700. The Septuagint 5872. The Talmud 5344. Hales 5411. Alphonso, king of Castile, 6934. Pezron 5872. The Greek church 5508. The early Fathers 5502 and 5592. Two hundred other authorities vary it from 6984 to 3268 B. C. The Jews are said to have altered the Hebrew text as an argument against the Christians.

Many critics believe that Adam was the Alorus of Central Asia, a chief, who first drew tribes into a social state. He had ten successors, or Dynasties, who lived hundreds of years similar to the ten Antedeluvian Patriarchs. It is also asserted, that the constellation Orion was formed from Alorus, and refers to this first chief.

This seems certain, that as no remains of man have yet been found below the alluvial or outer surface, so the human race must have originated since that terrestrial epoch when the last formations of deluvium took place, in which are found genera and species of animals, &c. no longer in existence; but with which man has not yet appeared to have been contemporary.

By the Editor's theory, that the chief part of the Northern hemisphere was submerged by the Perihelion Forces, between the years 4000 B. C. and 14,500 B. C. we fix a limit to these speculations; for none but high lands would be habitable before 7 or 8000 years B. C., and between that time and 5 or 6000 years B. C. all animals might multiply in the plains, and man then lay the foundations of our history. The Perihelion passed the Equator exactly 4000 years B. C. and then the land in the Northern hemisphere would take its present forms.

The next great epoch is the Deluge, and believing it to have happened after the age of Adam, it is impossible to speculate on its cause. Some ascribe it to the bursting of the Atlantic into the once fertile basin of the Mediterranean; and others to the irruption of the Euxine and other seas, through the Hellespont. Sacred history makes Noah, the 10th patriarch, escape in an ark, and profane history makes Xisuthrus, the 10th king of Sipporah in N. W. Syria, escape in like manner, and both to Caucasus.

The dates of this event must of course be traditional and conjectural. Sanchoniatho, Manetho, and the Greek schools, do not notice it, though they treat of events long anterior. Moses speaks of Vulcan and of giants, and god kings, before the Flood, and so do the above, but without a Flood. The Vulgate fixes it so late as 2348 B. C., but the Septuagint makes it 3246, the Samaritan in 2998, and Josephus in 3146; Cullimore quotes five or six other dates. The Laws of Menu speak of it like Moses, but their date, though of great antiquity, is uncertain. Amidst a thousand speculations, may it not be a tradition of a Perihelion Deluge, and demand other 3 or 4000 years to its epoch?

Josephus, in his 1st and 2d chapters, assigns 4053 years from Adam to the Exodus; then, if we add 1830 from Thuthmosis, per Young, to our era, we get 5883 from Adam to Christ, on his high authority. His 3d chapter, after the Exodus, is 2 years; 4th, 38 years; 5th, 76 years; 6th, 32 years; 7th, to the death of David, 40 years.

His 8th, is 163 years; his 9th, 157 years to the Captivity, when Josephus calls it 947 years from the Exodus, though the addition is but 908. He then makes it 182½ to Cyrus, and 253½ to the death of Alexander in 323, B. C., 759, which added to the 947 is 1706 from the Exodus to our era, to which add 4053, and we get 5759 + 1838 = 7697 from Adam.

In other places, Josephus claims 5000 years for the period of the Old Testament, to Nehemiah or Artaxerxes, and 3000 from Adam to Moses.

Manetho was expressly employed by Ptolemy Philadelphus to arrange the Dynasties, and he made a list of 31, distinguishing the

Theban from the Memphite, or Upper from Lower Egypt, when separate. There are, however, a party who discard the first 17 as fictitious, simply because the extension does not agree with the chronology of the Vulgate.

The Parian Chronicle is on marble, found at Paros, and (if true) formed in 284 B. C. It contains 79 paragraphs, from Cecrops, the first king of Athens, in 1582 B. C. (the period of the birth of Moses) to Dion, Tyrant of Syracuse. It speaks of some Mars and Neptune as contemporary in 1532. Of the deluge in the Ægean Sea, which drove Deucalion to Athens, in 1529, and of Hellen, his son, who gave the name of Hellenians to the north of Greece. Cadmus, on the same authority, built Thebes, as a Phœnician colony, in 1519. The first arrival of a ship from Egypt, under Danaus, in 1514. It tells that Minos the First reigned in Crete, in 1434; and mentions the arrival of Ceres, to teach the sowing of seeds, in 1409; and the sending of Triptolemus, to teach the same art to others, in 1406. It speaks of poems on the rape of Proserpine, the daughter of Ceres, in 1399. And of Hercules, as living in 1300; of the oracle of Apollo as existing in 1295, and of Theseus, as living in 1259. Of the siege of Troy, from 1218 to 1209. Of Hesiod in 944, and of Homer in 907.

Many of these dates do not accord with the Egyptian Chronology, but the Chronicle enables us, in two or three instances, to verify the dates of Manetho's list of Egyptian Kings. Thus, he states, that the local flood of Deucalion took place in the reign of Misphragmuthosis, and that Troy was taken in the reign of Thuoris, 1209. Both Manetho and Josephus assert that the Jews, or Hycsos, were driven out of Egypt by Thuthmosis, the first of a native dynasty, preceded by four Jewish kings, and Young, in ascending from Cambyses in 525, makes the middle of the reign of Thuthmosis 1774 B. C.

Josephus reckoned 393 years from the Exodus to Sethos, whom he considered as Sesostris, the brother of Danaus; but, if we take the middle of the reign of Sethos, or 1400, this would give 1793 for the expulsion. By the list, Thuthmosis began to reign in 1800, and reigned 50 years; and Manetho states, that he reigned 25 years and 4 months *after* the expulsion.

Annotators on Jerome's Vulgate make it 1491, a date which confuses all ancient history. The Shishak of the Jews, the Egyptian Seconchosis, by Young's list, began to reign in 971, and took Jerusalem, but he was not Sesostris, as Newton imagined.

Then we have the joint evidence of Manetho and Josephus, that the Jews, or Hycsos, were 511 years in Egypt, and this, added to 1775, gives 2286 for the immigration of Jacob and his family.

Adding, then, the agreed 290 to 2286, we get 2576 for the birth of Abraham; which, by Josephus, leaves 570 from the Deluge, or by the Septuagint 850, as the period in which society arrived at its state in the days of Abraham.

The observations of eclipses, &c. in India, Chaldea, &c. carry us to the same epoch of 3150, and the Chinese claim the year 2953 for the reign of Fohee; which are reconcileable with the Septuagint, which fixes the flood in 3426.

The 36,535 years claimed from Vulcan to Julius Cæsar, divided by 12·4 moons, per annum, gives nearly 3000 years. But astronomical periods as the Chaldean observations, are to be taken as astronomical days, and 430,000 by 365·2 gives 1177 years.

The loss of time in the Vulgate Chronology, in the 10th and 11th of Genesis; and in Judges, where in chap. ii. ver. 10, &c. 2 or 300 years are set down only as 20 and 30 years.

Chinese Chronology is founded on their observations of eclipses 4700 years ago. The Hindoos determined the mean motions of Saturn and Jupiter in 3102 B. C.

Manetho's 31 Dynasties include 5471 solar years, before Cambyses, but they included two sets when Egypt was divided, and may be safely taken at 3000 years. The sacred family of Chronus, not strictly Egyptian, lasted other 307 solar years. The Jews, in their five or six reigns of 190 years, destroyed every vestige of the previous dynasties, and the present ruins are chiefly those of the 18th and subsequent dynasties, which were not destroyed by Cambyses. Two Sothic periods of 1460 years elapsed about 250 B. C. and this carries back Thoth to 3170, which harmonizes all ancient chronology.

Those who would disturb these deductions, are constrained to represent the shepherd Hycsos and the shepherd Jews as distinct, contrary to the positive declaration of Josephus and others, that they were identical; so that unless a dozen peculiar circumstances happened alike to two races, and not one unlike, the difference cannot be maintained. Two nations were not driven out, and two did not flee to Canaan.

In constructing a chronological table, we are obliged to begin with uncertain periods. The best data seem to be cycles in succession, for these are preserved by universal consent.

Now Thoth invented a cycle of 1460 years to include the quarter days, *i. e.* 365 × 4, and this Phœnix returned about 240 B. C. Then twice 1460 is 2920, and 240 added is 3160 B. C. + 1838 = 5008. The living Thoth started this period, no doubt, from the first day of first month called after his own name. Then Thoth, we know, was contemporary with Chronus and his family, after whom he named the planets.

The next cycle is that of the Hindoos, of 60 years, of which they are now in the 42d of the 84th, that is 83 × 60 = 4980 + 42 = 5022 — 1838 = 3184 B. C. They have, also, 3 other cycles corroborative.

The third is the Chinese of 60 years, now in the 76th, *i. e.* 4560 — 1838 = 2722, about 260 years, after Fohee.

We have, also, various observations of eclipses, &c. about 3150 in India, China, and

Chaldea. Mankind appear, therefore, about this age, of 3200, to have made a start in civilization, and they afford corroborative evidence of each others science.

According to the Septuagint, the Deluge took place about 300 years before, or in 3426, and to Josephus in 3146, which must be wrong, if it was general.

	Before Christ.
The Deluge, per Septuagint,	3426
The Hindoo Cycle commenced	3184
Sothic Cycle do.	3160
Chinese Cycle	2722

The next following Dates are from Manetho and Sanchoniatho :—

Hephæstus and Vulcan, about	3300
Helius and Ouranus, about	3200
Chronus, about	3180
Dagon invented the plough, &c. about	3160
—as Ahsi-Erietis, or Osiris in Egypt, about	3150
The Planets named after Chronus, Jupiter, Ares, Astarte, and Taautus. The Sun after Apollo, and the Moon after Dione, about	3130
Taautus succeeded Misor, or Menes, in Egypt, about	3140
Taautus invented Hieroglyphics	——
——— the Sacerdotal System in Egypt	——
——— introduced medicine, mathematics, written laws, and regulations of time	——
Jupiter, son of Chronus, in Crete, about	3135
Belus, another son, in Babylon, about	3130
The Titan War among the children and wives of Chronus, about	3125
Fohee, in China	2980
Shinnong Ditto	2848
Eclipses, &c. recorded in China	2830
The Pyramids built, about	2700

Jewish and Greek Dates :—

Birth of Abraham	2576
Yao, Emperor of China	2357
Jacob goes into Egypt	2286
Thuthmosis, King of Egypt	1800
Exodus of the Jews, or Hycsos	1775
Flood of Ogyges	1764
Flood of Deucalion	1529
Cadmus builds Thebes	1512
Amunmai Rameses	1510
Danaus in Argos	1509
Utica and Cadiz built by the Phœnicians	1450
The Argonautic Expedition	1263
Theseus reigned in Athens	1259
Troy taken	1209
Codrus, King of Athens	1069
David, King of Israel	1053
Solomon's Accession	1015
Hesiod and Homer flourished	920
Carthage founded by Phœnicians	886
Death of Lycurgus	873
The First Olympiad	776
Rome founded	753
Samaria taken and tribes dispersed	721
The Pentateuch found by Hilkiah	625
Nebuchadnezzar flourished	600
Solon and Thales flourished	594
Jerusalem taken and destroyed	586
Cyrus became King of Persia	559
Babylon taken by Cyrus	538
Cambyses conquers Egypt	529
The Tarquins expelled	509
The Battle of Marathon	490
Aristides banished	484
The Sea-fight at Salamis	480
Herodotus flourished	445
Phidias flourished	440
The Peloponnesian War	431
Death of Pericles and Anaxagoras	428
Death of Socrates	400
Rome taken by the Gauls	385
The Death of Plato	348
Alexander destroyed Thebes	335
Alexander built Alexandria	332
Alexander died at Babylon	323
Aristotle and Demosthenes died	322
Macedonian Empire divided	301
Praxiteles died	288
The Alexandrian Library founded	283
Death of Epicurus	270
The First Punic War	264
End of the First Punic War	212
Romans conquered all Italy	226
Antiochus the Great	223
Battle of Cannæ	219
Second Punic War	218
Death of Archimedes	212
Jerusalem taken by Antiochus	203
Persius defeated	170
Battle of Zama	167
Judas Maccabeus flourished	166
The Last Punic War	149
Carthage destroyed	146
Greece, a Roman province	145
Death of Tiberius Gracchus	133
Athens taken by Sylla	86
Sylla perpetual Dictator	82
Syria conquered by Pompey	64
Cæsar landed in Britain	55
Gaul conquered	51
Cæsar made Dictator	49
Pompey killed	47
Cæsar killed	44
Cicero killed	43
Battle of Actium	31
Death of Horace	8
Birth of Christ	0

	After Christ.
Death of Augustus	16
Death of Ovid and Livy	17
Pilate governor of Judea	27
Sejanus put to death	31
Jesus Christ crucified	33
Death of Tiberius	37
Claudius succeeded Caligula	41
Claudius visited Britain	43
Nero succeeded Claudius	54
Boadicea defeated	61
Seneca and Lucan put to death	65
St. Peter and St. Paul put to death	67
Galba succeeded Nero	68
Otho succeeded Galba, and Vitellius Otho	69
Jerusalem taken and destroyed	70
Titus succeeded Vespasian	79
Pliny killed at Vesuvius	79

Domitian succeeded Titus	81
The Dacian war began	88
Death of Josephus	93
Nerva succeeded Domitian	96
Trajan succeeded Nerva	98
Death of Tacitus	99
St. Ignatius destroyed at Rome	108
The first Bishop of Rome	109
Trajan subdued Assyria	115
Jerusalem rebuilt, and the Temple dedicated to Jupiter	130
The Romans destroyed 580,000 Jews, and banished the rest from Judea	135
The Romans agreed to pay tribute to the Goths	222
Persian Kingdom restored	226
The Temple of Diana at Ephesus destroyed	260
The Teutons and Franks invade the Empire	263
The Goths and Heruli defeated by Claudius II., and 300,000 killed	269
The ninth Persecution of the Christians	272
Palmyra taken	273
Diocletian divided the empire	292
Constantine tolerated the Christians	323
The Council of Nice	325
Constantinople made the capital of the empire	329
The Mythological Temples demolished	331
Death of Constantine	337
Death of Eusebius	342
The Emperor Julian abjures Christianity	361
Theodosius emperor of the East	379
The Empire divided	393
Europe overrun by Alaric	401
Rome sacked by Alaric	410
The Romans left Britain	426
Genseric, the Vandal, overran Italy, and invaded Africa	439
Pope Leo the Great	440
Attila and the Huns overran Europe	447
The Frieselanders arrived in Britain, under Hengist and Horsa	451
Rome taken by Genseric	455
Other Frieselanders, under Octa, landed in Northumberland	457
Hengist murdered 300 British Chiefs at Knighton	475
Rome taken by Odoacer, who was made King of Italy, which put an end to the Roman Empire 1229 years after building Rome	476
Clovis, King of the Franks	481
Death of St. Patrick	491
The Bishop of Rome asserted his supremacy	494
Alaric defeated and killed by Clovis	507
Arthur, King of the Silures	515
The Christian Æra invented and introduced by Dionysius, a monk	516
Justinian made Emperor of the East	527
The Angles, a Gothic race, landed in the Northern counties	540
Death of Arthur	542
Totila, the Goth, took and plundered Rome	547
Retaken by Belisarius	549

And recovered by Totila	550
Death of Justinian and Belisarius	569
Latin tongue ceased to be spoken	580
The flight of Mahomet from Mecca to Medina	622
Death of Mahomet	633
Jerusalem taken by Omar	636
Saracens overran North Africa	698
Spain conquered by the Saracens	713
The Christian religion propagated in Germany	719
The Saracens in France	722
Charles Martel defeated the Saracens, near Tours	732
The Christian Æra first used in books	748
Bagdad built by Almansor	762
Charlemagne King of France	772
——— subdued the Saxons	781
Haroun al Raschid, Caliph	786
The Huns extirpated by Charlemagne	794
Charlemagne crowned at Rome	800
The Normans landed in France	808
Death of Charlemagne	814
The Heptarchy united by Egbert	827
Rome besieged by the Saracens	846
Christianity preached in Denmark and Sweden	8[illegible]0
The Danes ravaged England	867
Alfred defeated the Danes	878
Death of Alfred	901
Rollo, the Pirate, obtains Normandy	912
Sueno, King of Denmark	990
Sueno conquered England	1013
Canute, King of England	1017
Macbeth murdered Duncan	1040
The Turks took Bagdad, and overturned the Caliphate	1055
The Battle of Hastings, and Norman Conquest	1066
Feudal Law introduced	1070
Gregory VII., Hildebrand	1073
Doomsday-book finished	1086
First Crusade	1095
Jerusalem taken by the Crusaders	1099
William Rufus killed in the New Forest	1100
The Second Crusade	1147
The Bank of Venice established	1157
Becket killed at Canterbury	1171
Ireland conquered	1172
Jerusalem taken by Saladin	1187
Saladin defeated by Richard I.	1192
The Fourth Crusade	1202
The Inquisition established	1204
Gengis Khan overruns Asia	1206
King John excommunicated	1208
Magna Charta signed	1215
Russia conquered by the Tartars	1238
The Fifth Crusade	1248
Hanseatic league	1250
Wales conquered	1254
Bagdad taken by the Tartars, and the Saracen Empire terminated	1258
First English House of Commons	1258
Death of St. Louis at Tunis	1270
Moguls conquer China	1279
Massacre of the French in Sicily	1282
Wales united to England	1283
Death of Friar Bacon	1284
The Jews banished from England	1290

King of France excommunicated	1301
The Popes removed to Avignon	1308
Battle of Bannockburn	1314
Bruce, King of Scotland	1328
Battle of Cressy	1346
Great Plague in Europe and Asia	1349
Battle of Poictiers	1356
Turks take Adrianople	1361
The Popes returned to Rome	1377
A Second Pope chosen at Avignon	1378
Death of Wickliffe	1385
Battle of Angora	1401
France under a Papal interdict	1407
Battle of Agincourt	1415
John Huss burnt	1415
Jerome of Prague burnt	1416
Joan of Arc defeated the English	1428
Inundation at Dort; 72 villages and 100,000 people lost	1446
Constantinople taken by the Turks	1453
Battle of Towton	1462
Battle of Barnet	1471
Battle of Tewkesbury	1471
Castile and Arragon united	1479
Battle of Bosworth	1485
The Moors expelled Spain	1491
Cavanarola burnt at Rome	1498
Battle of Flodden	1513
Luther began to preach	1517
Magellan's Voyage	1519
Mexico invaded and plundered	1521
Battle of Pavia	1525
Rome taken by the Germans	1527
Servetus burnt by Calvin	1531
The Pope's authority in England abolished	1533
645 monasteries and religious houses suppressed in England	1539
The Council of Trent from 1545 to	1563
Cardinal Beaton put to death	1546
Interest fixed at 10 per cent.	1547
Eldest sons of Peers permitted to sit in the House of Commons	1505
Five Bishops burnt by Philip and Mary	1555
Charles the Fifth resigns his government	1557
Death of Calvin	1564
Rizzio murdered	1566
Massacre of St. Bartholomew	1572
Death of Knox	1572
Republic of Holland commenced	1579
Mary Queen of Scots put to death	1587
The Spanish Armada defeated	1588
The first newspaper in England	1588
Edict of Nantes tolerating Protestants in France	1598
East India Company established	1600
James I. of England, and VI. of Scotland	1603
Gunpowder Plot	1605
Spain acknowledged the independence of Holland	1609
Henry IV. of France assassinated	1610
Shakspeare died	1616
Vanini burnt at Toulouse	1619
Death of Cervantes	1620
Hugonot, or Religious War in France begun	1621
Death of Lord Bacon	1626
Buckingham assassinated	1628
Nine Members of the House of Commons imprisoned	1629
Bagdad taken by the Turks	1631
Battle of Lutzen	1632
Hampden's trial in the Exchequer	1637
Lord Strafford beheaded	1641
Massacre in Ireland	1641
Battle of Edgehill	1642
Death of Galileo	1643
Archbishop Laud beheaded	1644
Death of Hampden	1644
The Tartars overran China	1644
Battle of Marston Moor	1644
Battle of Naseby	1645
Charles I. delivered by the Scots	1647
Peace of Westphalia	1648
Charles I. beheaded	1649
Battle of Dunbar	1650
Death of Des Cartes	1651
Battle of Worcester	1651
War of England and Holland	1652
The English Fleet defeated	1653
Cromwell dissolved the Long Parliament, and made Protector	1653
Death of Gassendi	1656
Death of Harvey	1657
Death of Cromwell	1658
Charles II. restored	1660
Prussia independent	1663
Great Plague in England	1665
Great Fire of London	1666
Candia taken by the Turks	1669
Murder of the De Witts	1672
Death of Milton	1674
The Habeas Corpus Act passed	1678
Lord Russel and Algernon Sydney put to death	1683
Death of Colbert	1684
The Edict of Nantes revoked	1685
Battle of Sedgmoor	1686
Seven Bishops sent to the Tower	1688
Revolution in England	1688
Battle of the Boyne	1690
The English in Bengal	1690
The French Fleet defeated the English and Dutch	1691
Surrender of Limerick	1691
Battle of La Hogue	1692
The English funding system commenced	1694
Bank of England incorporated	1694
Treaty of Ryswick	1697
Battle of Narva	1700
Death of James II.	1701
Gibraltar taken	1703
Battle of Blenheim	1704
Barcelona taken	1705
Battle of Ramilies	1706
Battle of Almanza	1707
Battle of Oudenarde	1708
Battle of Pultowa	1709
Battle of Malplaquet	1710
Treaty of Utrecht	1713
The interest of money in England fixed at 5 per cent.	1714
Rebellion in Scotland	1715
Louis IV. died	1715
Septennial Act passed	1716
Death of Leibnitz	1716
Charles XII. killed	1718
The Mississippi Bubble	1719

The South Sea Bubble	1720
Death of Peter the Great	1725
Death of Newton	1727
Kouli Khan made King of Persia	1736
——— conquered the Mogul Empire	1739
Porto Bello taken	1740
Battle of Dettingen	1743
Anson's Voyage completed	1744
Battle of Fontenoy	1745
Battle of Culloden	1746
Kouli Khan murdered	1747
Lord Lovat, &c. beheaded	1747
Peace of Aix-la-Chapelle	1748
Earthquake at Lisbon	1755
Braddock defeated	1755
Battle of Colin	1757
Battle of Hockkerken	1758
Louisburgh taken	1759
Battle of Minden	1759
Quebec taken	1759
Havannah taken	1762
Treaty of Fontainbleau	1763
Wilkes's first election for Middlesex	1768
Ditto second and third	1769
The Shakspeare Jubilee	1769
Peace with Hyder Ally	1770
Partition of Poland	1772
Commencement of the American War	1775
Declaration of American independence, July 4	1776
Meeting of Deputies at London for Parliamentary Reform	1780
Riots in London	1780
Rodney's Victory over De Grasse	1782
Recognition of American independence	1782
Call of the States-general in France	1788
Taking of the Bastile	1789
Tuilleries taken	1792
French Republic proclaimed	1792
Louis XVI. guillotined	1793
French declaration of war against England and Holland	1793
Revolutionary Tribunal	1793
Robespierre guillotined	1794
The Bank of England suspended its payments in cash	1797
Buonaparte conquers Italy	1797
Rebellion in Ireland	1797
Buonaparte made Consul	1799
Battle of Marengo	1800
Peace of Amiens	1802
War renewed	1803
Buonaparte crowned Emperor	1804
Battle of Austerlitz	1805
Battle of Trafalgar	1805
Battle of Jena	1806
Battles of Friedland and Eylau	1807
Peace of Tilsit	1807
Napoleon seized Ferdinand	1808
Joseph Buonaparte, King of Spain. Jerome, King of Westphalia. Murat, King of Naples. Napoleon, King of Italy, &c. &c.	1808
Battle of Wagram	1809
Marriage of Napoleon with Maria Louisa	1810
Moscow burnt, and the French armies destroyed by frost	1812
Battle of Vittoria	1813
Battle of Leipsic	1813
Paris surrendered to the Allies	1814
Treaty of Fontainbleau	1814
Treaty of Vienna	1814
Napoleon returned from Elba	1815
Battle of Waterloo (June 18)	1815
Napoleon surrenders to the Bellerophon	1815
Treaty of Ghent, between England and America	1819
Tragical assault of petitioners at Manchester	1819
Republic of Columbia proclaimed	1819
Ditto Peru, Chili, and Mexico	1820
Death of Napoleon	1820
Death of George III.	1820
Trial of Queen Caroline	1821
Greece independent	1822
War of Russia and Turkey	1829
Catholic disabilities removed	1829
Death of George IV.	1830
Counter Revolution in France, and Charles X. expelled	1830
Poland conquered, and united to Russia	1831
The Bill for Parliamentary Reform passed	1832
Prince Otho, of Bavaria, chosen king of Greece	1833
Don Pedro invaded Portugal	1833
Miguel's fleet taken by Captain Napier	1833
Slave Emancipation Bill passed	1833
Attempt to assassinate Louis Philippe, July	1835
Municipal Corporations Bill passed, September	1835
New Marriage Act passed	1836
William IV. died June 20; Queen Victoria succeeded	1837
Queen Victoria crowned, June 28	1838

DISCOVERIES.

1405 The Canaries.
1420 Madeira.
1432 The Azores
1486 Cape of Good Hope, by De Gama.
1492 America, by Columbus.
1510 South America, by Amerigo Vespuccius.
1673 Louisiana, by the French.
1686 Easter Island, by Roggewein.
1690 Kamschatka, by the Russians.
1765 Otaheite, &c. by Wallis.
1770 New South Wales, by Cook.
1771 Sandwich Islands, by Cook.
1774 New Caledonia, by Cook.
1819 New South Shetland, by Williams.

The Icelanders discovered the Continent of America, about 1000, and called it Winenland, from the vines.

The South Sea was first seen by Europeans in 1513 from Mexico.

Japan was discovered in 1542.

Cape Horn was discovered by Le Maire and Schouten in 1616.

The discoveries on the North-west Coast have extended from East to West, to 149½ West, and from West to East, to 156½.

leaving 7 degrees in latitude 74 unexplored, or 140 miles.

Dates connected with the progress of knowledge and improvements.

274 Silk brought from India.
373 The Bible in Gothic.
400 Bells mounted.
493 Silk-worms in Europe.
660 Organs used.
663 Glass in England.
800 The Aristotelean Philosophy.
830 Oxford University.
991 The Arithmetical Digits.
1080 Doomsday-Book.
1124 Musical Notes.
1180 Glass in private-houses.
1200 Mariner's Compass.
1220 Astronomy cultivated in England.
1239 Coals dug as fuel.
1299 Spectacles invented.
1302 Cambridge University.
1319 Dublin University.
1336 Gunpowder invented.
1341 Petrarch crowned at Rome.
1360 Wickliffe flourished.
1436 Printing invented.
1454 University of Glasgow founded.
1464 Posts and diligences established.
1470 The first Almanac.
1471 Printing in England.
1517 Luther began to publish.
1543 Copernican System published.
1549 Telescopes invented.
1602 Decimal arithmetic.
1604 Satellites of Jupiter seen.
1614 Logarithms invented.
1619 Circulation of the Blood.
1623 Barometer invented.
1662 Royal Society established.
1680 Air-pump discovered.
1682 Philadelphia founded.
1710 Newcomen's Steam-Engine.
1716 Death of Leibnitz.
1720 Inoculation introduced.
1722 Electricity improved.
1726 Petersburgh Academy established.
1730 Fahrenheit's Thermometer.
1736 Gottingen University established.
1753 British Musuem established.
1768 Steam-Engines improved.
1771 Cook's First Voyage.
1773 Cotton-spinning Machinery.
1774 Oxygen discovered.
1778 Linnæus died.
1779 Hydrogen discovered.
1784 Euler died.
1789 Galvanism discovered.
1789 Atomic Theory suggested.
1797 Priestley died.
1798 Vaccination announced.
1781 The planet Herschel discovered.
1804 Gas-lights introduced.
1812 Lithography invented.
1813 Steam-boats invented.
1816 Steam Printing-engines.
1820 M'Adam's new roads.
1830 La Place, Davy, Young, and Wollaston died.
1831 Steam-carriages on railways and roads.
1832 Cuvier died.
1833 Magnetism and Electricity identified.

The past history of London records 16 visits of contagious pestilences in England. In 762, 1025, 1247, 1347, 1367, 1379, 1477, 1499, 1548, 1594, 1604, 1625, 1631, 1632, and 1665, averaging 73 years between each. Some change in the proportions of the constituents of the atmosphere, affecting various artificial constituents, is the presumed cause.

MATHEMATICS.

The sciences comprehended in mathematics are the arithmetic of figures, the arithmetic of signs, geometry and its collateral uses in mensuration, &c. They are the sciences of certainty, when confined to abstractions in numbers, form, and quantity; but pregnant with absurdity when applied to qualities, or moral, or metaphysical subjects, in which the data are uncertain, or vary in sense, relation, or degree, or are hypothetical, or assumed. Without a familiar acquaintance with arithmetic, with the use and force of algebraic signs, and some acquaintance with geometry and its uses, a man does not belong to the intelligent classes of society, and supposed difficulty indicates a mind of superficial character.

Signs express the relations of numbers and quantities. They are of different kinds, as

The sign of *addition*, $+$, called plus, as $a + b$, reads a plus b, or a added to b.

The sign of *subtraction*, $-$, called minus, as $a - b$, reads a minus b, or b subtracted from a.

The sign $-$ always means subtraction and never negation or less than nothing, except relatively. Whenever it stands alone, as $-a$, the a has been separated from some positive quantity, but it still means only subtraction.

The sign of *multiplication*, $\times$, as $a \times b$, signifies that a is multiplied by b. Multiplication is also expressed by a full point (.) and by *into*, as

$\overline{a+b} . \overline{c+d}$, or $\overline{a+b}$ into $\overline{c+d}$.

The sign of *division*, $\div$, as $a \div b$ signifies that a is divided by b; or it is in the form of a fraction, as $\frac{a}{b}$.

The sign of *equality*, $=$, as $a + b = x$, or a added to b is equal to x.

The sign of *difference*, $\backsim$, as $a \backsim x$, signifies either $a - x$ or $x - a$.

7 is put between two quantities, to express that the former is greater than the latter, as a 7 b, or a more than b; $\angle$ signifies the reverse, as $a \angle b$, or a less than b.

A *Vinculum* is a line drawn over an expression to denote the root, &c. of the expression, as $\sqrt{\overline{a+b}}$, and sometimes the same is expressed by parenthesis, as $\sqrt{}(a + b)$; or $(a + b)\, x$ means that x is multiplied by their sum.

A ratio is expressed by : or : :, thus, as 4 : 2 : : 8 : 4, that is, as 4 is to 2, so is 8 to 4, or as $a : b : : c : d$.

Ratios are also expressed as fractions, that is, $\frac{4}{2} :: \frac{8}{4}$ or as $\frac{a}{b} :: \frac{c}{d}$ or with $=$ between them, as $\frac{4}{2} = \frac{8}{4}$ or $\frac{a}{b} = \frac{c}{d}$. Every fraction is the ratio of the numerator to the denominator, or of the denominator to the numerator.

The *radical* sign $\surd$, denotes the root of the quantity, as $\surd a$ is the square root of a; or the cube, biquadrate, &c., as $^3\surd a$, $^4\surd a$, &c.; or by fractions, as $a^{\frac{1}{2}}$, $a^{\frac{1}{3}}$, $a^{\frac{1}{4}}$, $a^{\frac{1}{n}}$, for the square, cube, biquadrate, and the nth or unknown, or general root of a.

a^{-1}, a^{-2}, a^{-3}, &c. denote inverse powers of a, and are equal to $\frac{1}{a^1}$ $\frac{1}{a^2}$ $\frac{1}{a^3}$ &c.

$$\frac{x}{y^2} = x\,y^{-2}, \text{ or } x^2\,y^3 \text{ may be } \frac{x^2}{y^{-3}},$$

or $\frac{1}{x^{-2}\,y^{-3}}$.

A full point before a figure denotes a decimal, read from the point as tenths, hundredths, &c., thus, ·5 is five tenths, ·05 five hundredths, &c., and better to distinguish, a 0 is placed before 0·5, or 0·05, &c.—(*See Blair's First Lines of Arithmetic.*)

In the Roman notation, IↃ or D, stood for 500; and C after them, for as many hundreds as C's; CIↃ, or M, was 1000, with C's for odd hundreds.

M, with a dash over it, was one million: X, with a dash over it, 10,000. The Ↄ is tenfold the number to which it is added.

The decimal division of days, degrees, &c., was used in China 4000 years since.

The word digit, applied to the 10 figures, comes from *digitus*, a finger; computation being, in ancient times, performed by fingers.

We are indebted for Euclid, Ptolemy, and Aristotle, to the Arabian universities in Spain. Athelard, of Bath, translated Euclid from Arabic into Latin, about 1130. In the 11th and 12th centuries, all learned men travelled to Toledo and Cordova.

Stiefel suggested the principle of Logarithms, in 1530.

The Differential calculus of Leibnitz finds a small quantity, which, taken an infinity of times, is equal to a required quantity; and Fluxions consider momenta as quantities. One is expressed by d, as dx, and the other by a dot, as $\dot{x}$. Fluxions were an invention of Newton, and at the same time and independently Leibnitz invented the Differential calculus. Newton's invention is however laid aside, and the differential calculus preferred by modern mathematicians.

Geometry is connected with mechanics *solely* because the rectangle, or multiple, of quantity and velocity is always equal to force or momentum.

The results of mathematical analysis depend always on the data. Analysis applies the data, or any data, but it proves nothing as to the datum, which is either some presumed fact or theory, and may be true or false. It merely determines certain conditions and consequences of the data assumed; but in the determination does not prove the truth of the data: for the analysis is an *abstract* enquiry founded on the data.

In calculations, lines or single dimensions can only be compared with lines; superficies or double dimensions with superficies; and cubes or treble dimensions with cubes.

The same principle applies to all arithmetic; we cannot add or multiply pounds and pence, or miles and yards, or tenths and whole numbers. Denominations of figures must be alike.

There is no ratio between finites and infinites, all finites having the same indeterminate ratio to the mere creation of the mind called infinity; therefore, all knowledge is strictly limited to the ratios of finites.

All momentum is quantity of matter multiplied into velocity; and all momentum or power is evidence of matter and velocity acting in the direction of the resulting momentum.

Quantity of matter in cubes is detected only by relative momenta, as in the varied momenta of weight; or the varied reaction of resistance, in the same medium, &c.

Bodies in motion determine, by the mutual reaction of their connected parts, a line of direction, which line always passes exactly through the centre of all the atoms of the body. The existence of this line of direction, and of this centre of all the atoms, are evidence that the body is under the government of the force of motion; and, on the contrary, motion is proof that the line and centre exist in the body. For this reason, the line of direction and centre of gravity in falling bodies, is proof that such bodies are subject to motion, and not to any peculiar power, as was fancied in the dark ages.

Prime numbers are those which have no divisor; perfect numbers are those which are equal to the sum of all their divisors. The prime or indivisible numbers under 100 are 2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47, 53, 59, 61, 67, 71, 73, 79, 83, 89, 97.

To convert a mixed quantity into a decimal, express it fractionally, and then divide the numerator with cyphers, by the denominator. Thus, 5*s.* 6*d.* as the decimal of a pound is $\frac{11}{40}$ as a vulgar fraction; then 11 000 by 40 gives ·275 for the decimal.

Decimals of Fractions.

$\frac{1}{2}$ = ·5	....	1-5th	=	·2
$\frac{1}{4}$ = ·25	....	2 5ths	=	·4
$\frac{3}{4}$ = ·75	....	1-7th	=	·142857 &c.
$\frac{1}{8}$ = ·125	....	1-9th	=	·1111 &c
$\frac{3}{8}$ = ·375	....	1-11th	=	·090909 &c.
$\frac{5}{8}$ = ·625	....	1-12th	=	·08333 &c.
$\frac{7}{8}$ = ·875	....	1-16th	=	0625
$\frac{1}{3}$ = ·333 &c.		1-20th	=	·05
$\frac{2}{3}$ = ·666 &c.		1-24th	=	·041666 &c.

Decimals of Mixed Quantities.

1*s*. is ·05 of one pound.
1*d*. is ·0041666 of one pound.
1 farthing is ·0010416 of a pound.
1 inch is ·08333 of a foot.
1 lb. is ·0008928 of a cwt.
1 oz. is ·000558 of a cwt.
1 yard is ·000568 of a mile.
1 inch is ·0000158 of a mile.
1 day is ·002739 of a year.
1 minute is ·000694 of a day.
1 dwt. is ·004166 of a lb. troy.
1 square yard of an acre 0·0002066116.
1 quart of a bushel 0·00390625.
1 grain of a lb. troy 0·00017361.
1 ounce of a cwt. 0·000557857.

Logarithms, so useful in philosophy, are an arithmetical series in contrast with a parallel geometrical series, by which the multiplication of any two terms of one series corresponds with additions of the other. The Logarithms for PRIME Numbers, under 100, are as under, and all others may be formed from these by mere multiplications and additions :—

2— ·301030	43—1·633469
3— ·477121	47—1·672098
5— ·698970	53—1·724276
7— ·845098	59—1·770852
11—1·041393	61—1·785330
13—1·113943	67—1·826075
17—1·230449	71—1·851258
19—1·278754	73—1·863323
23—1·361729	79—1·897627
29—1·462398	83—1·919078
31—1·491362	87—1·939390
37—1·568202	97—1·986772
41—1·612784	100—2·000000

The index is always one less than the number of digits in the whole number.

As examples of the use of the above, all the powers of each number are found by multiplying by 2, 3, 4, &c. Thus the Log. of 4 is twice that of 2; of 8 is thrice; of 16 is 4 times; and so on. And the Log. of 9 is twice that of 3, of 27 is three times, &c. So the multiples of any two of the figures give the sum of their Logs. for their Log. Thus $2 \times 7 = 14$, and the Logs. of 2 and 7 added, are the Log. of 14. This short table will, therefore, produce any desired Logarithm of any number.

Naper's and Briggs's Logarithms.

Nos.	Naper's log.	Briggs's log.
1	0·000000	0·000000
2	0·693147	0·301030
3	1·098640	0·477121
4	1·386294	0·602060
5	1·609438	0·698970
6	1·791759	0·778151
7	1·945910	0·845098
8	2·079441	0·903090
9	2·197225	0·954242
10	2·302646	1·000000

Naper's are a constant multiple of Briggs's, called *Hyperbolic* Logarithms, by 2·302646; but Briggs's are those in general use, and found in all the tables, as Nicholson's, Hutton's, &c.

Binary logarithms were invented by Euler to facilitate musical investigations, and 2 is their integer instead of 10 in the common, and 1 in the hyperbolic.

The following are the logarithms for several oft-recurring numbers:—

Log of the arc of a quadrant 1·57079 = 0·196118.

Of the chord = 0·150515.

Of the circle (radius, 1) = 6·283 = 0·798180.

Of the circle (diameter, 1) = 3·1416 = 0·49714987.

Of the earth's circumference, 24869 = 4·395658.

Of earth's rotation per second at the equator, 1521·5 feet = 3·182272.

Of days in a year = 2·562592.

Of seconds in a day = 4·935326.

Of the moon's fall in her orbit per minute, 128814 feet = 5·109963 (not 16 feet!)

Of second's pendulum London 39·1393 = 1·592644.

Of the French metre 39·37079 English inches = 1·595173.

Of the imperial gallon 277·274 cubic inches = 2·442919.

The first Six Powers, 2 *to* 9 :—

1st	2d	3d	4th	5th	6th
2	4	8	16	32	64
3	9	27	81	243	729
4	16	64	256	1024	4096
5	25	125	625	3125	15625
6	36	216	1296	7776	46656
7	49	343	2401	16807	117649
8	64	512	4096	32768	262144
9	81	729	6561	59049	531441

The following are the first Six Powers of $a + b$; and $a - b$ is the same with + and — alternately :—

Square.—$a^2 + 2ab + b^2$. And $a - b$ is $+ a^2 - 2ab + b^2$.

Cube. $a^3 + 3a^2b + 3ab^2 + b^3$.

4th Power. $a^4 + 4a^3b + 6a^2b^2 + 4ab^3 + b^4$.

5th Power. $a^5 + 5a^4b + 10a^3b^2 + 10a^2b^3 + 5ab^4 + b^5$.

6th Power. $a^6 + 6a^5b + 15a^4b^2 + 20a^3b^3 + 15a^2b^4 + 6ab^5 + b^6$.

The square of the square is the 4th power, and the square × by the cube is the 5th power. The square of the cube is the 6th power.

$\frac{2}{3} \times \frac{2}{3} = \frac{4}{9}$ = square of $\frac{2}{3}$.

$\frac{4}{9} \times \frac{2}{3} = \frac{8}{27}$ = cube of $\frac{2}{3}$.

$\frac{8}{27} \times \frac{2}{3} = \frac{16}{81}$, biquadrate of $\frac{2}{3}$, and so of others.

Any number taken any number of times is a power of that number, and it may be

expressed as a power. And to find the power, we have only to divide the logarithm of the number of times by the number of times, and the quotient is the power. Thus, $3a$ is $a^{1 \cdot 69}$; for if we take the log. of $3 =$ 0·477125 and divide it by 3, we get 0·159040, which is the logarithm of the root of a, or of a multiplied into itself, so often as to produce treble its own sum.

If we divide the logarithm of any number by the index of any power, the quotient is the logarithm of that root of the power whose index has been used. And conversely if we require any power of any number, we obtain it by multiplying the logarithm of the number by the index of the power, and the product is the logarithm of the power of the number.

Dr. Hutton's rule of Trial-and-Error is very useful. He assumes two roots, one of them too little, and the other too great; and then using them in the expression makes a denominator of their difference, and a numerator of the excess of the true value of the expression over the least result. The value of this fraction, added to the assumed least number is the approximate root. He then uses this as the least, and takes another near it, but too much, and by two or three repetitions gets the root very nearly.

A proportion, or ratio of two numbers, is greater or smaller as the quotient of their division is more or less. Thus 6 is to 2 in greater proportion than 6 to 3, because $\frac{6}{2}$ gives more than $\frac{6}{3}$.

In *Ratios*, if $a : b :: c : d$

Then $a : c :: b : d$.

And $ad = cb$, or $\frac{a}{b} = \frac{c}{d}$

And $a + b : b :: c + d : d$

And $a - b : b :: c - d : d$

If b equal c

Or $a : b :: b : d$,

Then b is a *mean proportional* to a and d.

It is also a *third proportional* to a and ad.

And it has to c a *duplicate ratio* of a to d.

Then also $ad = b^2$; and b is the square root of ad.

When a is to b as b to c, and c to d, and d to e, then a is a *triplicate ratio* to d, the third term; and a *quadruplicate* to e, the fourth term.

Duple ratio is that of 2 to 1. *Subduple* that of 1 to 2. *Duplicate* ratio is that of the square of one number to the square of another. *Sub-duplicate* is the ratio of the square roots.

In a proportion, the two extremes and the two means are similar terms, and being so kept may be arranged in eight different ways, their products being always equal. Any multiple, or part, of dissimilar terms does not disturb the proportion. And two proportions multiplied or divided, term for term, are still proportional. And so equal powers, or roots, of the terms proportional.

Every number is its ratio to 1, thus 5, is 5 to 1; or 4, is 4 to 1. And every number may be expressed fractionally, thus 5 is $\frac{5}{1}$; or 4 is $\frac{4}{1}$; 5 to 1 is therefore the same as $\frac{5}{1}$; or 4 to 1 the same as $\frac{4}{1}$. Every ratio may therefore be expressed as a fraction, and every fraction as a ratio.

In every triangle. the 3 angles are equal to 2 right angles, or 180°.

In every right-angled triangle, the square of the hypothenuse is equal to the squares of the base and perpendicular.

Triangles are the half of paralellograms of the same perpendicular heighth and base.

The 4 angles of paralellograms are 4 right angles.

The sides of an hexagon are equal to the radius of its circle.

The sides of every triangle are proportional to the sines of the opposite angles.

The tangent is a fourth proportional to the cosine, sine, and radius.

The secant is a third proportional to the cosine and radius.

The cotangent is a fourth proportional to the sine, cosine, and radius.

The cosecant is a third proportional to the sine and radius.

Taking the radius as 10,000 *parts* :—

Deg.	*Sine.*	*Cosine.*
1	175	9998
3	523	9986
5	872	9962
7	1219	9925
9	1564	9877
11	1908	9816
13	2250	9744
15	2588	9659
17	2924	9563
19	3256	9455
21	3584	9336
23	3907	9205
25	4226	9063
27	4540	8910
29	4848	8746
31	5150	8572
33	5446	8387
35	5736	8192
37	6018	7986
39	6293	7771
41	6561	7547
43	6820	7313
45	7071	7071

Cosines above 45° taken upwards.

Sines for the next 45° taken upwards.

For intermediate degrees, add the two next, and divide by 2.

For the last ten degrees of the quadrant, the sines are nearly equal parts, the difference, per minute, in the 81st degree being 287½. and those in the 80th and 90th being 291, hence every sine is merely 291 less per minute in those degrees. For one minute it is 291 and $\frac{291}{60} = 4{\cdot}85$ is the sine of one second, the radius being one million; and the multiple of 4·85 is the sine for any number of *seconds* below a minute; and so for *thirds*, as to 4·85, if required.

It is a property of triangles, that if each of any two of its sides be × by the cosine of the angle which the side taken makes with the third side, the sum of the products is equal to that third side.

The diameter of a circle is to its circumference as 113 to 355, or as 1 to 3·141593. And the circumference, to the diameter, as 1 to 0·318309

The circumference of a circle whose diameter is 1, is = 3·14159265358979323846264338327950288419716939937510 58 09749145923 0781640628620899862803482534211706798214 80865132723066470938446., &c—*Goodwin.*

In a circle, calling D the diameter, C the circumference, A the area, and P 3·14159,

$$D = \frac{C}{P} \text{ or } \frac{4\ A}{C}, \text{ or } 2 \sqrt{\frac{A}{P}}$$

$$C = P\ D \text{ or } \frac{4\ A}{D}, \text{ or } 2 \sqrt{P\ A}$$

$$A = \frac{P\ D^2}{4} \text{ or } \frac{C^2}{4\ P}, \text{ or } \frac{D\ C}{4}$$

$$P = \frac{C}{D} \text{ or } \frac{4\ A}{D^2}, \text{ or } \frac{C^2}{4\ A}$$

The length of an arc is 8 times the chord of half less the chord of the whole, and divided by 3.

The periphery of an ellipse is the square-root of half the sum of the squares of the 2 axes by 3·14159.

The arc of a quadrant 1·5707963, is 10.9ths the chord 1·414214.

The chord of the third of a circle, diameter 1, is 1·732051. Of a fourth, 1·414214. Of a fifth, 1·17557. Of a sixth, 1. Of a ninth, 0·68404. Of a twelfth, 0·517638.

The length of a circular arc is the radius × by degrees in the arc × by 0·017453.

The decimal of a degree, or 360th of the circle, is 0·00872664626.

The square-root of 2 is 1·41421356.

The square-root of the circle is 1·77245385.

The square of the circle is 9·8696.

The radius of a circle is equal to an arc of 57·2957795 degrees.

Conic Sections are the figures made by a plane cutting a cone, and according to the different positions of the cutting-plane there arise five different figures or sections, *viz.* a *triangle*, a *circle*, an *ellipsis*, an *hyperbola*, and a *parabola :*

When the cutting plane passes through the vertex of the cone, and any part of the base, the section is a *triangle.*

When parallel to the base, the section is a *circle.*

An *ellipse* when the cone is cut obliquely through both sides, or when the plane is inclined to the base in a less angle than the side of the cone is.

A *parabola*, when the cone is cut by a plane parallel to the side, or when the cutting-plane and the side of the cone make equal angles with the base.

An *hyperbola*, when the cutting-plane makes a greater angle with the base than the side of the cone makes.

The sum of an arithmetical Series is found by adding the first and last terms, and multiplying by half the number of terms. Any term is the first term added to the additional number of common differences. If the first term is 3, and the common difference is 5, then the twelfth term is 11 × 5 + 3 = 58. When the first and last are given, any intermediate terms are found by subtracting the two terms, and dividing by one more than the number of terms sought for the common difference. Thus, if we want 6 terms between 5 and 40, then 40 — $5 = \frac{35}{6+1} = 5$; and 5, 10, 15, 20, 25, 30, 35, 40 is the series.

Every geometrical series being the continued multiplication by a fixed difference, the terms are, (r being the difference) a, ar, ar^2, ar^3, &c. to ar^n for n terms. The last term, therefore, is ar^{n-1}, because the first involves no power of r. The sum of an ascending Series is found by multiplying the last term by the common ratio—subtracting the first term and dividing the difference by the ratio less 1. The sum of a descending series is found by deducting the power of the ratio raised to the number of terms from 1, and dividing the difference by 1 less the ratio, and multiply this quotient by the first term. And the sum of a descending *infinite* series is found by dividing the first term by 1 less the common ratio.

If a be the first term of a geometrical series; r the common ratio; z the last term; n the number; and s the sum of the terms. Then

$$a = s + r\,z - r\,s.$$

$$z = \frac{s\,(r^n - r^{n-1}}{r^{n-1}}$$

$$s = \frac{z\,r^n - z}{r^n - r^{n-1}}$$

$$r = \frac{s-a}{s-z} - \left(\frac{z}{a}\right)^{\frac{1}{n-1}}$$

When a body falls in a vertical line by the two motions of the Earth, we have s the space fallen, v the velocity, t the time, g the gravity or force of weight.

$$s = \tfrac{1}{2}\,g\,t^2 = \frac{v^2}{2\,g} = \tfrac{1}{2}\,t\,v$$

$$v = g\,t = \frac{2\,s}{t} = \sqrt{2\,g\,s}$$

$$t = \frac{v}{g} = \frac{2\,s}{v} = \sqrt{\frac{2\,s}{g}}$$

$$g = \frac{v}{t} = \frac{2\,s}{t^2} = \frac{v^2}{2\,s}$$

The fall of bodies through 16·08 in 1 second, is 48·24 in the second second, 80·4 in the third, and 112·56 in the fourth second, making 257·4 in the four seconds, and so on. This acceleration is ascribed, by Galileo, to any continuous force, as motion added to motion, but the same effect will arise on a body abandoned to the two terrestrial motions, owing to the spaces generated by the rotation being superfices.

The acquired force of a falling body is usually taken as equal to its weight when it

has fallen an inch and a quarter. At the end of a foot in a quarter of a second, it acquires, therefore, (the square-root of the heighth fallen) a force 3·1 times its weight, and 3·1 more in every quarter of a second. That is, 12·4 at the end of a second, 24·8 at the end of 2 seconds, and so by multiples of quarter seconds.

If a body fall 16 feet the first second, and if the descent be a proportion to the squares of the times; the second column of the following table gives the space fallen in each successive quarter of a second, and the third column gives the whole space fallen.

Quarter Seconds.	Feet per Quarter.	Whole Space Fallen.
0·25	1	1
0·50	3	4
0·75	5	9
1·00	7	16
1·25	9	25
1·5	11	36
1·75	13	49
2·00	15	64
2·25	17	81
2·5	19	100
2·75	21	121
3·00	23	144
3·25	25	169
3·5	27	196
3·75	29	225
4·00	31	256

The greatest height to which a projectile ascends, is the square of the velocity by the square of the sine of elevation. The time of flight is the velocity into the sine of elevation.

A body, raised with a given velocity, will rise with retardation to such a height as, in falling again by acceleration, confers the first velocity.

The Area of every paralellogram is its heighth by its base; or, if the sides are unequal, take the mean of the two, or the square-root of their product. When the angles are not right angles, take the perpendicular heighth.

The area of a triangle is half the base into the heighth.

The area of a triangle, whose sides only are given, is found by taking half their sum, subtracting each side, and then multiply the half continually by the three remainders, and the square-root of product is the area.

In reducing square yards to acres, instead of dividing by 4840, multiply by 0·000203.

The area of a circle is 11-14ths of the square of the diameter, or 7-88ths of the square of the circumference.

If the square of the diameter of a circle be × by 0·7854, the product is the area.

The diameter of a sphere cubed and multiplied by 0·5236 is the solidity.

The square of the diameter multiplied by 3·14159 is the surface of sphere.

The surface of a sphere is 4 times the square of the radius into 3·1415927. The solidity is cube of radius into 4·18879.

The area of a circle whose diameter is 1 is 0·7853981, and the side of an equal square 0·8862269. Diameter 2 is 3·14159265, and square 1·77245384.

The square whose sides are 1 is equal to a circle whose diameter is 1·112837917.

The proportion of the area of a circle to its circumscribed square, is as 11 to 14.

The area of a sector is half the arc by the radius.

To find the surface of a spherical zone multiply the product of the diameter into the heighth by 3·14159. To find the solidity. add the squares of half the two diameters to 1-3d of the square of the heighth; multiply this sum by the heighth, and this by 1·5708.

For the area of spheres or parts, the circumference by the heighth, whether sphere, zone, or segment.

Pyramids are one-third of prisms of equal base and heighth. They are to each other as their bases and heighths. One-third of the area of the base by the heighth is the solidity. The surface is half the product of the length of the base by one of the sides.

To find the area of a spherical triangle, multiply the difference between the sum of its three angles, and two right angles by the radius of the sphere.

Areas of Polygons, whose sides are 1 :—

Sides.	*Polygons.*	*Areas.*
3	Trigon	0·4330127
4	Tetragon, or Square	1·0000000
5	Pentagon	1·7204774
6	Hexagon	2·5980762
7	Heptagon	3·6339124
8	Octagon	4·8284271
9	Nonagon............	6·1818242
10	Decagon	7·6942088
11	Undecagon..........	9·3656399
12	Dodecagon..........	11·1961524

For an ellipsis, multiply the product of the two axes by ·7854.

For the solid contents of a prism or cylinder, the area of the base by the heighth.

A paraboloid is the area of the base by the heighth and two-thirds the product.

A spheroid is the multiple of the fixed axis by the square of the revolving axis, and by ·5236.

The area of a cycloid is triple that of the generating circle.

The sum of the squares of the bung and head diameters, and of the square of double the intermediate diameter into the length, and into 0·785398, then divided by 6, is the contents of a cask.

The length by the square of the diameter both in inches, into 0·00283257, is the contents of a cylinder in imperial gallons.

The mean diameter of a cask is nearly half the sum of both, or the square-root of their product.

To measure trees multiply the feet in the length by the square of the inches, and divide for cubic feet by 2304. Or when an 8th, or 10th for bark, by 3009 or 2845.

A standing tree is measured by squaring 1-4th of the girth, and multiplying it by the heighth of the trunk.

The length of a tree into the square of its mean girth, by 1807, is its cubic feet; or for 1-8th bark by 2360.

To find the area of any very irregular plane, draw it on paper, and with the same paper cut any regular square, and their areas will be as their weights.

The contents of any irregular body are determined by the quantity of water, or sand, which it displaces in a regular vessel.

In land-surveying, it is usual to divide into all forms, to arrive at the true area of irregular forms.

There are 384 bricks in a cubic yard, and 4356 in a rod.

In cross-multiplication 12 fourths is a third, 12 thirds a second, and 12 seconds an inch. Feet into inches are inches, and into seconds are seconds; inches by inches are seconds, and by seconds are thirds; seconds by seconds are fourths.

The convexity of the earth interposes to prevent the sight of distant bodies: thus, at 600 yards, 1 inch would be concealed, or an object an inch high could not be seen in a straight line; at 900 yards, 2 inches: at 1400 yards, 5 inches; at 1 mile, 8 inches; 3 miles, 6 feet; so that at that distance a man would be invisible; 4 miles, 10 feet; 5 miles, 16 feet; 6 miles, 24 feet; 10 miles, 66 feet; 12 = 95; 13 = 112, and 14 miles, 130 feet.

In levelling, it is usual to allow the 10th of an inch in every 200 yards, or 8 inches in a mile, for convexity.

In all horizontal distances, 1-13th should be added to the distance for horizontal refraction, and Legendre says 1-14th. Making this allowance, and remembering that a mile curvates 8 inches, we may determine a distance by knowing the elevation, or an elevation by knowing the distance. By multiplying 8 inches by the square of the distance; thus, if it is 10 miles, 10 times 10 is 100, and 100 times 8 inches is 66 feet, as stated. If the top of a mountain is seen at 50 miles distance, it would be 2500 times 8 inches, equal to 1666 feet of elevation, to which adding 1-14th for refraction, it would make the hill about 1800 feet high.

For visible distances multiply the Earth's diameter 7920 by the heighth of the eye above the sea. Thus, at 2 miles, it is the square-root of 15840, or 126 miles. At 4 miles 31680, or 178 miles; at half a mile 3960, nearly 63 miles, at a quarter of a mile 1980, or 44½ miles, and at 220 yards, or the 8th of a mile, 31½ miles.

When both bodies are elevated, the two heighths are to be added. So we determine distances by knowing heighths and boundary of vision. On a smooth surface, two bodies, 10 feet high, are invisible to each other at 8 miles distance. The proportion of the Earth's surface visible is as the heighth to 7960, so that at 1 mile we see the 7960th, of the surface and so on.

A man five feet six inches high, on the sea-shore, or on level ground, can see about three miles distant.

The dip of the horizon for various heighths of the eye is as under, to be deducted from the degrees per quadrant. At 5 feet for the heighth of the eye at sea, the dip is 2 min. 8 sec.; at 10 feet, 3 min. 1 sec.; at 20 feet, 4 min. 16 sec.; at 30 feet, 5 min. 14 sec.; at 60 feet, 7 min. 23 sec.; and at 100 feet 9 min. 33 sec.

To approximate distances, Gregory gives it as a rule for every foot in the heighth of the object to divide 3437·73 by the minutes in the angle, or 206264 by the seconds; and multiply by the feet in the heighth.

The *vernier* scale is 11-tenths divided into ten equal parts, so that it divides a scale of 10ths into 100ths, where the lines meet even in the two scales.

The *Chain-rule* solves many complicated questions. A dozen circumstances produce one result, and a dozen others some other which is required; we then multiply each set, and their quotient is the answer. To effect this, we enter the terms in two columns. The first on the right, is the term of demand, or what is sought. Then to the left, enter the same in kind, and on the right what it is equal to. Then, again, on the left, the same in kind as the last and its equal. Proceed thus, till all are set down, then multiply each set, (purged of similar numbers on each side) and their quotient is the answer. It is useful in Exchanges, &c.

The number of Changes which any number of things, as Bells, Letters, Cards, &c. can produce, is the product of all the figures multiplied together, thus:—1, 2, 3, 4, 5, 6 bells, produce 720 changes.

The 26 letters of the alphabet make 403 quintillians of combinations; 20 make 2½ quadrillions; and 12 make 479 millions.

In general, 2 raised to the power of the number of things, and 1 subtracted, is the number of all possible combinations. Thus, in 12 bells or notes, two raised to the 12th power—1 is every combination. Then the log. of 2 = ·301030 × 12 = 3·612360, is 4096 — 1 = 4095 combinations.

And in the 26 letters of the alphabet, ·301030 × 26 = 7·826780, log. of 67111193 — 1 = 67111192 positions of the 26 letters.

A player at whist may hold above 635 thousand millions of various hands; so that continually varied, at 50 deals per evening, for 313, or 15,650 hands, per annum, he might be above 40 millions of years before he would have the same hand again.

Eight persons, at a round table, can be seated 5040 ways.

If an event may take place in many different ways, and each be equally likely to happen, the probability that it will take place in a particular way is properly represented by $\frac{1}{n}$, certainty being unity.

If an event may happen in a ways, and may fail in b ways, the chance of its happening is $\frac{a}{a+b}$, and the chance of its failing, is $\frac{b}{a+b}$.

The probability of throwing an ace with a single die, in one trial, is $\frac{1}{6}$; and the probability of *not* throwing an ace is $\frac{5}{6}$. The probability of throwing either an ace or a deuce, is $\frac{2}{6}$.

If balls *a*, *b*, *c*, *d*, &c. be thrown promiscuously into a bag, and a person draw out one of them, the probability that it will be *a* is $\frac{1}{n}$; and the probability that it will either be *a* or *b* is $\frac{2}{n}$. If two balls be drawn out, the probability that these will be *a* and *b* is $\frac{2}{n.\ (n-1)}$.

If 6 white and 5 black balls be thrown promiscuously into a bag, and a person draw out one of them, the probability that it will be a white ball is $\frac{6}{11}$; and the probability that it will be a black ball is $\frac{5}{11}$.

If two events are independent of each other, and the probability that one will happen be $\frac{1}{m}$, and the probability that the other will happen $\frac{1}{n}$, then the probability both will happen is $\frac{1}{mn}$. The probability that both do not happen is $1-\frac{1}{mn}$, or $\frac{mn-1}{mn}$. And the probability that they will both fail is $\frac{(m-1)(n-1)}{mn}$. The probability that one will happen and the other fail is $\frac{m+n-2}{m\ n}$.

If there be any number of independent events, and the probabilities of their happening be $\frac{1}{m}$, $\frac{1}{n}$, $\frac{1}{r}$, &c. respectively, the probability that they will all happen is $\frac{1}{mnr\ \&c.}$

The chance of throwing an ace is $\frac{1}{6}$, and the chance of throwing a deuce in the second trial is $\frac{1}{6}$; therefore the chance of both happening is $\frac{1}{36}$.

If 6 white and 5 black balls be thrown promiscuously into a bag, the probability of drawing a white ball *first* is $\frac{6}{11}$, and then the probability of drawing a black ball is $\frac{5}{10}$, or $\frac{1}{2}$, because there are 5 white and 5 black balls left; therefore the probability of white and black is $\frac{6}{11}\times\frac{1}{2}=\frac{3}{11}$.

In the probability of throwing an ace, with a single die, in two trials; the chance of failing the first time is $\frac{5}{6}$, and the chance of failing the next is $\frac{5}{6}$, therefore the chance of failing twice together is $\frac{25}{36}$, and the chance of not failing, both times, is $\frac{25}{30}$, or $\frac{11}{36}$.

There are 36 chances upon two dice. It is an even chance that you throw 8. It is 35 to 1 against throwing any particular doublets, and 6 to 1 against throwing any doublets. It is 17 to 1 against throwing any two desired numbers. It is 4 to 9 against throwing a single number with either of the dice, so as to hit a blot or enter. Against hitting with the amount of two dice the chances against 7, 8, and 9, are 5 to 1; against 10, is 11 to 1; against 11, 17 to 1; and against sixes is 35 to 1.

The probabilities of throwing required totals with two dice, depend on the number of ways in which the totals can be made up by dice. 2, 3, 11, or 12, can only be made up one way each, and, therefore, the chance is but 1-36th. 4, 5, 9, 10, may be made up two ways, or 1-18th. 6, 7, 8, three ways, or 1-12th. The chance of doublets is 1 36th, the chance of particular doublets is 1-216th.

The chance is equal, in dealing cards, that every hand will have seven trumps in two deals, or seven trumps between two parties, and also four court cards in every deal. This is so certain, on an average of hands, that nothing can be more superstitious and absurd than the prevailing notions about luck or ill-luck.

The chance of having a particular card out of 13, is 13-52nds, or 1 to 4, and the chance of holding any two cards is 1-4th of 1-4th, or 1-16th. The chances of a game are generally inversely as the number got by each, or as the number to be got to complete each game.

The chances against holding 7 trumps are 160 to 1; against 6, it is 26 to 1; against 5, 6 to 1; and against 4 nearly 2 to 1. It is 8 to 1, against holding any 2 particular cards.

To determine the number of Combinations which any number of things will form in 2, 3, 4, &c. at a time. Multiply the number of things by the number less 1, and this product by the number less 2, and so on, as the number of formations is 2. 3, 4, or more. Divide the last product by the product of 1, 2, 3, &c. as it may be, and the quotient is the answer. Thus, six things in three at a time, is $\frac{6\times 6-1\times 6-2}{1\times 2\times 3}=\frac{120}{6}=20$ ways, so in hands at whist, four at a time $\frac{52\times 51\times 50\times 49}{1\times 2\times 3\times 4}=\frac{6374900}{24}=265629$ hands.

M. Joubin, of Havre, by a very acute analysis, assimilates every numerical expression to the equation $f\,10^n + q$, in which f is the number of units in the figure; 10^n the power of 10 in that place, and q the lower additive. He thus expands any numerical expression as of 6 figures, or 247169, by putting x for 10, into $fx^5 + fx^4 + fx^3 + fx^2 + fx^1 + fx^0$, or $2 \times 10^5 + 4 \times 10^4 + 7 \times 10^3 + 1 \times 10^2 + 6 \times 10^1 + 9 \times 10^0$. $f\,10^n + q$, taken at any term. As at 7, then it becomes $247 \times 10^3 + 169$. This analysis then enables M. Joubin to make many determinations as surprising as new and original. Thus he readily assigns to a dividend or divisor. the fraction necessary to make them commensurate, and his great aptitude at calculation enables him to multiply 3 figures by 3 in one line, taking in mentally, by a sort of cross-multiplication, the products of the inferior lines. His series also enable him to break down large numbers into their component factors, with inconceivable readiness.

Zerah Colborn, the calculating boy, in a minute or two could give the exact product of five or six figures, by five or six, or extract the square or cube-root of eight or ten figures. George Bidder, another calculating boy, did the same.

Angular measure is the inclination of two lines. When perpendicular, it is 90 degrees, called a *quadrant*; 60 are a *sextant*, and 45 an *octant*. These degrees are divided into 60 minutes, each minute in 60 seconds, each second into 60 thirds, &c. This is called *sexagenary*, and was the ancient arithmetic. Latterly, an attempt has been made to introduce decimal divisions into minutes, as better according with general calculations, but retaining the 90° in the quadrant, and the 360° in the entire circle. A centesimal degree is 54 minutes.

An angle of a minute, in a circle of vision of 10 inches distance, or 20 inches diameter, is but the 350th of an inch; and in a circle of 72 inches, a second is but the 5700th of an inch. In the Earth's orbit, a second is equal to 451 miles. At the distance of the fixed Stars, (40 billions,) a second would be 192,900,000. so that the orbit of the Earth would, at that distance, be but a second.

SPECIFIC GRAVITY, OR STATICS.

Specific gravity, or weight in species, is the measure of force with which matter, in its various forms, falls, when unsustained, towards the earth's centre. It is best determined by poising solids in water, and in regard to gases in air; and the relation to equal bulks of water or air, is the relative weight of an equal bulk, called the specific gravity; gravity being, in this case, a mere synonyme with weight.

That weight is a mere phenomenon of motion, is evident to sight; but it is further proved, by the fact that every body, while falling, generates the usual line of motion or centre, which is generated by all moving bodies. It is called in one, the centre of gravity or weight; and in the other, the centre of percussion. This motion is in the diagonal of the two motions of the earth, and always directed from the circumference of double motion, to the centre of uniform, but least motion.

The centre of the Earth moves with a mean velocity of about 97,890 feet per second; but the rotation of 1521·5 feet per second at the equator deflects every part of that circle, a mean 969 feet perpendicularly from the line of the centre, and simultaneously through the entire 360 degrees. It is, therefore, an inverse force to the orbit force equal to $969 \times 6{\cdot}283 = 6086{\cdot}227$.

Then $\frac{97890}{6086\cdot} = 16{\cdot}083$, which in round numbers is the increase of the motion of the diagonal of both motions, directed to the centre, or is the mean fall of a body in a second.

Then, since the hemispheres consist of 2 dimensions, heighth from the plane, and proportionate diminution of rotation, measured in a sphere by the sine and cosine of the latitude; and, as the rotation in generating areas has a force as the square of the radius, so the same now prevails every where, $\cos.^2 + \sin e^2$ being $= \text{rad.}^2$

And since in an oblate spheriod the sines become too short near the poles, and $\cos.^2 + \sin e^2$ is then less than rad.^2, the inverse force is, therefore, less, and the ratio or quotient 16·083 is greater, as is known to be the fact.

Again, as the motions generate areas, and the *times* are as the equable motions, so the fall is accelerated as the square of the times.

Further, since $\frac{\text{Orbit}}{6{\cdot}283 \text{ Def.}} = \text{F}$, or fall, so F by observation $\times$ 6·283 Def. ($= 4 \times$ rot.) is equal to orbit per second, and we thus learn the Earth's distance by known physical numbers.

The equation is also susceptible of other alternations and varieties.

No proposition can be more clear in the circle of human investigations, and, indeed, no other resembles it; and though the Editor submitted it in 1826 to the world, yet it is not received in the schools, because it does not harmonize with the absurd and superstitious, and impossible principle of the attraction of universal weight or gravitation!

If a progressive motion acted alone on a mass, it would form a train of the rarer parts, and *disperse* them. If a rotative motion acted alone, it would direct the parts in tangents, and *disperse* them. Their combination direct the parts to the centre, and the two become a force of aggregation, centripetal force, gravity, or weight.

In a revolving sphere the mean force is at 30°, when the cosine is half the radius, but there being in the 2 hemispheres 2 such cosines, the mean force is that at the equator.

Space is the extension of matter, or of matter in motion, or, in fine, the extension of MATERIAL POWER; every equal space having within it an equal momentum, or a tendency to equality, created by more matter and less motion, or by less matter and more motion.

Some paradoxical writers, by an equivocation, deny the existence of matter: but philosophy treats justly of an actuality, called matter, whose various quantities and densities, in various motions, produce all the phenomena sensible to relatively material beings, and this to them is matter.

There is always proof of the presence of matter, when power is displayed on other matter; and also, that the said matter is in motion, since all power displayed on other matter is the power of some matter in motion. Power and matter in motion are convertible terms. By power is meant action on other matter, since our senses take cognizance of no other power, and true philosophy takes cognizance only of actualities, not of creations of fancy like powers of attraction, repulsion, and the like.

In like manner, liquidity is a state of matter maintained by the atmospheric pressure of 15 lbs. to the square inch, and the liquid becomes gas as this pressure is reduced; or, as the excitement of heat or atomic motion is so increased in the liquid as to overcome the atmospheric pressure. It then takes the expanded orbit form of gas.

Matter is either concrete, liquid, or gaseous. In the first, the atoms are mutually fixed and combined, whatever be their interstices or density. The motion of heat converts some into fluids, and when increased, into gas; but, in others, the conversion is into smoke, or vapour, or gaseous. Fluidity is an intermediate state, preserved by the pressure of the atmosphere; but in various intractable substances, the heat or motion required to change the form at once overcomes the atmospheric pressure, and they expand as smoke or gas.

In the concrete state the atoms have no motion, but their interstices are filled with gas, which forms also their local atmospheres, producing inflections of light and certain affections on the surfaces of other bodies; but no chemical union or affection of the matter of the bodies. In the liquid state, the matter of the bodies is dissolved or combined with the gases in the interstices, so as to produce a mobile substance, or liquid restrained by atmospheric pressure, and susceptible, by mixture, of chemical and mechanical union with other liquids. But in the gaseous state, the atoms are projected, and then repelled into orbits by the atmospheric pressure, and maintain a space or volume by re-action; for all projectiles, uniformly re-acted on, are converted into orbit motions.

The various relative unions, actions, and re-actions in the fluid, and chiefly in the gaseous state, may be considered as the effect of forms of the respective atoms, which permit, assist, or oppose union, in a variety of degrees, as they are like or unlike, constituting all the phenomena of affinity, repulsion, combination, &c. &c.

Atoms of matter, or their first compounds, unite as grains or fibres, but more commonly in juxta-position of fitting sides as chrystals; and their indefinite smallness renders them, when in union, impervious to our coarse edged-tools, and separable only by friction, blows, heat, or other forms of intense motion, acting and re-acting among the atoms.

No limit can be set to the smallness of atoms, which still maintain definite actions and re-actions. The imagination cannot reach the divisibility of matter; an ounce of gold-wire may be drawn out 50 miles; and in leaves 300,000 are but an inch, or 1500 to a sheet of thin paper. A grain of cerulin or aloetic acid tinges 5 pints of water; but animalculæ, and their perfect parts and formations, prove that diminutiveness is even more wonderful than enlargement, and yet the atoms of the sustaining elements must be even less.

In one of Newton's speculations, he imagined that if the matter of the whole earth were compressed into absolute solidity, it might be reduced to a body but a few yards in diameter. Reduced to a sphere of 1 mile in diameter, the matter to the interstices would be but as 1 to 510,000,000,000.

Densities are so various, while the bodies still maintain their space and integrity, that a cubic foot of platinum weighs 20,000 ounces, while one of cork weighs only 240; of ether 716; of water 1000; air but 1·285. Hence the law of equal power in equal space demands an inverse activity of the atoms, or 19,000 to 1 as to platinum and air, and 92 to 1 as to platinum and cork.

That we do not see matter in any simplicity, is evident from the consideration, that every part of the earth is moved 49 times more than that of a cannon-ball at issuing; and certainly equal to a cannon-ball in other directions. While the actions and re-actions of such a system are the life of nature, it baffles our conceptions.

Cohesion is destroyed either by a sudden blow, or by imparting so much heat, or atomic motion, as produces a general motion of the atoms in orbits, owing to re-actions of other atoms. It is computed that atoms begin to cohere when within the 250 millionth of an inch. That aqueous vapour has its particles at such distance, and that particles of water are the 10,000 millionth of an inch asunder, or from that to the 2,000 millionth.

Bodies at rest never move, unless some force is impressed on them in the direction of any motion which they acquire.

All motion in bodies, whether masses or atoms, has been transferred to them in the direction in which they move.

Within our sphere of observation there is no original motion.

Bodies have no force or momentum but what they derive from some transferred motion of another body in motion.

The force or momentum of a body in motion, is the quantity of atoms which it contains, by its velocity in the line of direction of the centre of all the atoms united in the mass.

As every body parts with its motion only to other bodies which then display it, so *action* is transferring motion, and *re-action* is receiving what is transferred, both therefore equal. *Percussion* is one mode of parting with motion, *friction* another, and *resistance* another, all resolvable into mere transfer *Reflections* and *deflections* arise from the velocity being parted with only on the striking side.

Power or momentum in any body or atom is evidence that it is in motion, whether the power be massive or chemical.

In chemical powers there is no action between fixed or concrete bodies, however antagonist or in juxta-position; and reciprocal energies appear *only* when they have acquired the motion of fluidity, and the atoms are intermingled.

When one body moves another body, their subsequent velocity is lowered as their joint mass is increased. Large bodies move small ones by division of velocity, often miscalled re-action.

Small bodies in great motion are reflected by much larger ones, because the impulse affects only the adjacent parts of the large one, which returns it by perpendicular vibration, making the angles of percussion and reflection equal.

Action and re-action are always equal, and in directions varying as the angle of impulse.

Impulse is the union of a body in motion with another body. The force continues the same, but the velocity is as the mass of the first to the mass of the two.

Small bodies are moved by large ones, because involved in their motion.

Action and re-action being equal, whether in contact, or by intervention, so any law of force with which intervening bodies may transmit the action of either to the other, has the same effect reciprocally; and as equal action and re-action always result, the law of force is *neutral* as to both. When two bodies are fixed at the ends of a rod, and made to turn on a pivot *horizontally*, in circles inversely as their masses, it signifies not whether the intervening rod is of wood, brass, or iron, or what is the law of the cohesion of its parts, for it is the same for one as for the other.

Wherever there is matter in velocity, there is force, and vice versa. And when the same quantity of matter in equal velocity produces different modes of force, the differences may be ascribed to forms which yield or combine variously.

Diminution of volume always gives out heat, because the motion which sustained the expansion, is parted with. So enlargement of volume abstracts and absorbs motion or heat from surrounding bodies.

Since the laws of the communication of motion are essentially similar, we may reasonably infer, cæteris paribus, that the motions of atoms resemble those of sensible aggregates.

And with regard to all aggregates and atoms on the earth, or connected with it, we seem warranted in concluding, that there is no motion or force on the sphere of the earth which is not, directly or indirectly, derived from its two great motions, and part or parcel of them, excepting only those atomic motions, which are derived from the light and heat of the Sun.

Masses describe spaces, but forces only the lines which pass through the centre of gravity; hence the spaces are as the square of the velocities, while the force is only as the velocity of the line in the centre of the mass.

Bodies in motion in one direction, have no force of motion in any direction but that in which they are moving; consequently, there can be no mutual repulsion when the bodies are each moving from the other.

Bodies do not act where they are not present, unless by the intervention of other bodies, fluids, or gases; and they move other bodies, or these in maximum, only in the direction of their own motions.

There is no force but impulse in some form or other; and no motion but in the direction of an impulse, which impulse is necessarily on the contrary side of the body to that part to which the body moves. A body on the right hand cannot, therefore, by any force of its own, make a body on the left hand move to the right, or towards itself, since it is not present on the side from which the impulse must proceed.

Whenever, therefore, bodies go together, or move from one another, without sensible cause, the effects do not arise from any cause which is an exception to Mechanical Action; but the cause, or causes, become a proper object of philosophical enquiry, and its discovery involves the correct conception of the collateral phenomena; and such a discrimination of the laws of action as would facilitate both practice and theory. Such a determination would be *knowledge*, and the want of it is *ignorance*.

The momentum of a body in motion is a constant test of its number of atoms, since it is always equal to $V \times Q$ With the uniform velocity, therefore, which is produced in bodies, in the diagonal of the two terrestrial motions, weight, or centripetal form, is universally as the number of atoms in the body. But there is a diminution of weight in the same number of atoms, whenever the atomic motion, called Heat, has converted a concrete mass into a liquid or gas, since, in this condition, the atoms have great lateral motions, which counteract the perpendicular force of the two motions in producing weight.

Motion seems to be a necessary adjunct of all matter, and determines the density of bodies by their atomic quantity, and the form of the atoms, and the central force by the direction of their motions.

Direct and oblique motions are merely

relative to the position of the agent and patient. Every motion as to the mover is direct, and the obliquity, as it is called, is in the direction of the striking line. The direct motion is that of the constant centre of the mass, and the obliquity is the angle of the impinging point, with the line of direction of the centre.

If a body, put in motion, suffered no resistance, or friction, or were not previously involved in other motions, as part of a system, it would move for ever. But this is an hypothetical case, since all bodies move in air, or some medium which receives part of their motion; or they are involved in other motions.

Bodies in motion display power, miscalled Inertia, as the angle of any deflecting body, with the line of direction, increases. If the lines concur, there is no inertia: if 180°, the inertia is a maximum; if at 90°, it is a mean; and this is the inertia of bodies on the earth whenever we seek to move them at right angles, or draw them horizontally. The inertia, as it is called, is merely their own previous force downwards.

Breaking in pieces is when the action and re-action is greater than the cohesion, or union of the parts; and the motion after breaking, is the display of the first motion, and the deflection aside and around are the re-acting vibrations.

Elasticity in hard bodies means the vibrations of the adjoining fibres, when struck by another hard body. Those vibrations return the motion, and hence the usual rebound. Elasticity in gases is the greater or less orbits of their atoms, as the excitement, or their susceptibility, is greater or less.

There is no space void of MATERIAL POWER, owing to the elasticity or orbit motions of atoms of gas, which enlarge as any space presents itself; that is, any space less filled with power than any other space, as in the pores of bodies, and spaces between the planets and stars.

Fluids press equally in all directions, upwards, downwards, obliquely or laterally.

Solids press only *downwards*, or in the direction of the earth's centre.

The upper surface of a fluid at rest is horizontal, and seeks to become so.

The velocity of waves is as the square-root of their breadth. Thus, if the summit of 2 waves are 16 feet asunder, and of others 4 feet, the velocity is 2 to 1. A pendulum equal to the breadth vibrates in the time that the waves proceed.

The pressure of a fluid on every part of the vessel containing it, is equal to the weight of a column of the fluid, whose base is equal to that part, and whose height is equal to its depth below the upper surface of the fluid.

The pressure of fluids on a square inch, at the depth of 30 feet, is 13 lbs., at 3,000 feet 1,300 lbs.; and on a square foot, at 35·84 feet, is a ton, and at 105 feet 3 tons.

The pressure of a fluid on a lighter body, rarer fluid, arises from the heavier fluid seeking to maintain its own level, or the level of its own weight. The extraneous body is, therefore, driven upward. So with gases, steam, vapour, smoke, &c.

Air would become as dense as water from its own weight, at a depth of 34 miles; and water would be of double density at 93 miles, and as heavy as mercury at 362.

Gravity or weight is the name of an effect, and every cause, or all the causes, are equal to the effect; so, in quantity, the effect in this case may be taken for the cause. But, philosophically and logically, if the causes are various and compounded, we cannot take the result or effect as the cause.

Again, the several kinds of going together, of which gravity is one case, may have different causes; and it is, therefore, very illogical to ascribe the whole to one cause, or to a property of matter. Nor ought we, when the causes are explained, and their explication serves as the basis of various reasoning, to treat them as of no consequence, because the effect is their uniform result. We might, in like manner, treat every other investigation of causes, as that of combustion, with contempt, because we are familiar with its effect. Vulgar truths and philosophical investigations are totally distinct.

To determine the number of fixed atoms in any bulk by their downward tendency, the hydrometer is a very convenient instrument, and it gives the specific gravity within the 40,000th part. In other cases, on a body being weighed in and out of water, as the lost weight in, is to that out, so is the specific gravity of water to that of the body.

Taking water at 32° as 1, at 41° it is 1·0001032; at 46·4 is 1·0000129; at 48·2 is 0·9999579; at 59° is 0·9993731; at 68° is 0·9985615; at 77° is 0·9974668; at 86° is 0·9960993; at 122° is 0·9881227; at 149° is 0·9798108; at 185° is 0·9661788; at 203° is 0·9584651; and at 212° is 0·9544219.

These being taken as to water, cubic foot to cubic foot, and a cubic foot of water being 1000 ounces, or 62½ lbs., so these figures express the weight of *a cubic foot* of each; and if divided by 1728, the quotient is the weight of a cubic inch of each in ounces; and the weight of any plate of any metal or wood is known, by dividing the weight of an inch by the number of plates to an inch.

Specific gravities are determined by dividing the weight of the body, of the same bulk, by the weight of air or water.

Specific Weights of the Gases.

Air	1·0000
Hydriodic Gas	4·443
Fluo-silicic	3·573
Chloro-boric	3·42
Arsenical Hydrogen	2·695
Chlorine	2·47
Fluo-boric Acid	2·371
Sulphurous Acid	2·234
Cyanogen	1·806
Phosphoric Hydrogen	1·761
Protoxide of Azote	1·52

Carbonic Acid	1·5245
Hydro-chloric Acid	1·2474
Proto-phosphoric Hydrogen	1·214
Hydro-sulphuric Acid	1·1912
Oxygen	1·1026
Deutoxide of Azote	1·0388
Bi-carbonated Hydrogen	0·978
Azote	0·976
Carbonic Oxide	0·957
Ammoniacal Gas	0·5967
Carbonic Hydrogen of Marshes	0·555
Hydrogen	0·0688

Specific Weights of Vapours.

Air	1·0000
Bi-chloride of Tin	9·199
Vapour of Iodine	8·716
Vapour of Mercury	6·976
Vapour of Sulphur	6·617
Proto-chloride of Arsenic	6·3
Chloride of Silicum	5·939
Hydriodic Ether	5·4749
Camphor	5·468
Benzoic Ether	5·409
Oxalic Ether	5·087
Proto-chloride of Phosphorus	4·875
Essence of Terebenthine	4·763
Yellow Chloride of Sulphur	4·73
Naphtalin	4·528
Vapour of Phosphorus	4·355
Red Chloride of Sulphur	3·7
Hypo-nitric Acid	3·18
Acetic Ether	3·067
Sulphur of Carbon	2·644
Hypo-nitric Ether	2·626
Sulphuric Ether	2·586
Hydro-chloric Ether	2·212
Chloride of Cyanogen	2·111
Pyro-acetic Spirit	2·019
Alcohol	1·6133
Hydro-cyanic Acid	0·9476
Water or Aqueous Gas	0·6235

Liquids.

Distilled Water	1·
Sulphuric Acid	1·8409
Nitrous Acid	1·55
Water of the Dead Sea	1·2403
Nitric Acid	1·2175
Sea Water	1·0263
Beer	1·034
Madeira	1·038
Milk	1·03
Claret	0·9939
Burgundy	0·9915
Olive Oil	0·9153
Muriatic Ether	0·874
Essential Oil of Terebenthine	0·8697
Naphtha	0·8475
Alcohol, pure	0·792
Sulphuric Ether	0·7155

Specific Weights of Solids. Water at 64° 1.

Distilled Water		1·
Platina	Laminated	22·069
	Fibrous	21·0417
	Forged	20·3366
	Purified	19·5
Gold	Forged	19·3617
	Melted	19·2581
	Jeweller's	15·709
Tungsten		17·6
Mercury (at 32°)		13·598
Lead		11·3523
Palladium		11·3
Rhodium		11·0
Silver		10·4743
Bismuth		9·822
Copper, Fibrous		8·8785
Copper, Red		8·788
Molibdenum		8·611
Arsenic		8·308
Nickel		8·279
Uranium		8·1
Steel		7·8163
Cobalt		7·8119
Iron Bars		7·788
Tin		7·2914
Cast Iron		7·207
Zinc		6·861
Antimony		6·712
Tellurium		6·115
Chromium		5·9
Ponderous Spar		4·43
Jargon of Ceylon		4·4161
Ruby, Oriental		4·2833
Topaz, Oriental		4·0106
Sapphire, Oriental		3·9941
Sapphire of Brazil		3·1307
Topaz, Saxon		3·564
Beryl, Oriental		3·5489
Diamond, Rose-colour		3·531
Diamond, Lighter		3·501
Spar-fluor, Red		3·1911
Lime-stone		3·179
Tourmaline, Green		3·1555
Asbestus		2·9958
Hone		2·876
Basalt		2·864
Marble of Paros		2·8376
Quartz-jasper Onyx		2·816
Chalk		2·784
Porphyry		2·765
Emerald		2·7755
Pearls		2·75
Marble		2·742
Granite		2·654
Coal		2·7182
Quartz-jasper		2·7101
Coral		2·68
Slate		2·672
Pebble		2·664
Flint		2·594
Glass, Flint		3·3293
Glass, White		2·892
Glass, Bottle		2·733
Glass, Green		2·642
Portland-stone		2·52
Paving-stone		2·416
Mill-stone		2·484
Crystal, Rock		2·653
Quartz-agate		2·615
Felspar		2·5644
China-ware		2·3847
Coals, Sulphuretted		2·3117
Porcelain of Sèvres		2·1457
Sulphur, Native		2·0332
Bricks		2·
Ivory		1·917
Alabaster		1·874
Anthracite		1·8
Alum		1·72

Bone, Ox	.. .. ..	1·659
Honey	.. .. ..	1·456
Solid Oil	.. .. ..	1·3292
Lignum Vitæ	.. .. ..	1·333
Ebony	.. .. ..	1·331
Amber	.. .. ..	1·078
Oak	.. .. ·97 to	1·17
Tallow	.. .. ..	0·945
Camphor	.. .. ..	0·989
Sodium	.. .. ..	0·9726
Ice	.. ..	0·93
Ambergris	.. .. ..	0·926
Box	.. .. ..	0·912
Wax	.. ..	0·897
Logwood	.. .. ..	0·913
Potassium	.. .. ..	0·8651
Yew	.. .. ..	0·807
Beech	.. .. ..	0·696
Elder	.. .. ..	0·695
Walnut	.. .. ..	0·671
Pear-tree	.. .. ..	0·661
Pine	.. .. ..	0·66
Fir	.. .. ..	0·75
Teak	.. .. ..	0·745
Apple-tree	.. .. ..	0·733
Orange-tree	.. .. ..	0·705
Cyprus-wood	.. .. ..	0·598
Cedar-wood	.. .. ..	0·561
Larch	.. .. ..	0·544
Elm	.. .. ..	0·556
Mahogany	.. .. ..	0·56
Willow	.. .. ..	0·585
White Poplar	.. .. ..	0·529
Sassafras-wood	.. ..	0·482
Common Poplar	.. ..	0·383
Cork	.. .. ..	0·24

The weight of atmospheric air, at 32°, is to distilled water as 1 to 770, and of air to mercury as 1 to 10166.

A cubic *Inch* of zinc and cast-iron weigh 4·16 ounces; of steel and bar-iron 4½; of brass 4·858; copper 5; silver 6; lead 6¼; cast-gold 10 1-5th; pure platinum 11·285, and laminated 12¾ ounces.

A cubic *Foot* of paving-stone is 151 lbs.; mill-stone 155 lbs.; granite 165 87 lbs.; slate 167 lbs.; marble 171½ lbs.; chalk 174 lbs.; basalt 179 lbs.; lime-stone 198¾ lbs.

A cubic *Foot* of oak is from 54 to 73 lbs.; of ebony 83 lbs.; of box 57 lbs.; yew 50½ lbs.; ash 47½ lbs.; teak 46½ lbs.: beech 43¾ lbs.; walnut 43 lbs.; mahogany 35 lbs.; elm 34¾ lbs.; larch 34 lbs.; poplar 24 lbs.; and cork 15 lbs.

100 cubic inches of air weigh 31 0117 grains; of hydrogen 2·1614 grains; of carbureted hydrogen or coal gas 17 3025 grains; of nitrogen or azote and olefiant gas 30·2794 grains; of oxygen 34·6048 grains; of muriatic acid gas 40·0121 grains; of carbonic acid 47·4691 grains; of chlorine 77·8615 grains; and of hydriodic acid gas (the heaviest) 100 cubic inches weigh 135·176 grains, being 4½ times the weight of air, and 4 times that of oxygen.

430·25	*cubic* inches of cast-iron weigh 1 *cwt.*	
397·60	,, ,,	bar iron
368·88	,, ,,	cast brass
352·41	,, ,,	cast copper
272·8	,, ,,	cast lead

14·835	*cubic* feet of paving-stone weigh 1 *ton*	
14·222	,, ,,	common stone
13·505	,, ,,	granite
13·07	,, ,,	marble
12·874	,, ,,	chalk
11·273	,, ,,	lime-stone
64·46	,, ,,	elm
64·	,, ,,	Honduras mahogany
51·65	,, ,,	Mar Forest fir
51·4	,, ,,	beech
47·762	,, ,,	Riga fir
47·158	,, ,,	ash, and Dantsic oak
42·066	,, ,,	Spanish mahogany
36·205	,, ,,	English oak

O. Gregory.

A square foot of *cast* iron, one inch thick, weighs 38 lbs. 10 7 ounces; of malleable iron 39 lbs. 13·1 ounces; of copper 47 lbs., and of lead 59 lbs.—Other thicknesses in proportion.

100 inches of wrought-iron bars, one inch square, weigh a quarter of a cwt.

An iron shot, of 4 inches diameter, weighs 9 lbs.; and a lead one of 4½, 17 lbs.; and others to these are as the cubes of their diameters.

Hammering renders metals more dense, and heating in fire restores them.

A body falls at the equator in a second of time 16·045223 feet; in the lat. of 45° per Sabine 16·095375; at London, 51° 31′, in 16·093; and at Paramatta, in 33° 48′, 16·0703 feet; or, per mean, 16·08728 feet.

The fall of a body at the level of the sea, (per Kater), in the latitude of London, is in a second exactly 16·085375 feet, or 368·289 inches at the level of our seas.

The centripetal force being known at 45°, that at the poles is its multiple by 1·002837, and at the equator by ·0997163.

A cubic foot of rain-water, which weighs 62½ pounds, presses at 30 feet deep 13 pounds per square inch, and at 3000 feet is 1300 pounds. At 36 feet the pressure per square-foot is a ton, and 108 feet nearly 3 tons.

MECHANICS AND MACHINERY.

Mechanics are the practical economy of Motion and Matter, and they consist of various contrivances, to vary momentum by varying the velocity or impulse. They are also made to vary the directions of the motion, so as to produce particular effects.

Power is gained by increasing the velocity of the acting force, and when speed is required in the work, by diminishing the velocity of that force: for power at one end of a machine into its velocity, is always equal to velocity and power at the other end; and there is no exception to this law, except in the allowance to be made for friction and resistance, from one-third to one fifth.

The contrivances for conveying the pow of a machine to the work, are

Wheels and pinions on axles.
Conical wheels.
Rack work.

Belts, bands, and chains.
Cranks, single and double.
The universal joint.
The sun and planet wheel.
The ball and socket.

The lever of Lagoaroust, for producing a rectilinear from a circular motion.

Spiral geering, is when the cogs or teeth are cut obliquely, to act with slight friction.

Conical drums, inverted to each other, increase and decrease velocity, as desirable. Wheels of different diameters, on parallel axis, put in and out of geer, effect the same purpose; also, by an eccentric crown-wheel, which varies the velocity.

Tilting-hammers, fulling-hammers, &c. are raised by cams or wipers, which are connected with the axis of motion.

Cartwright's reciprocating crank converts a rectilinear into a circular motion, by two opposed joints, which turn two wheels into one another. The encycloidal wheel is a very simple means of converting rectilinear into circular motion.

The toggle-joint is a lever of oblique action.

A machine merely directs and modifies the force which has been transferred to it.

Universally to determine the power of a machine, divide the velocity of the action by the velocity of the power. For the actual effect, multiply this by the force of the power, and deduct a fourth for friction.

In wheel-machinery, to determine the number of revolutions of the last-moved part for one of the first-moved part, divide the product of the cogs in the driving-wheels by the product of the cogs in the driven.

Reversing a motion is merely crossing a belt, or making one wheel work into another.

A force of 50 lbs. per second, imparted to a loaded wheel, so accumulates, as to enable it to overcome a resistance of nearly 500 lbs. in ten seconds; and this is a FLY-WHEEL. This not only equalizes power, but it is accumulated by making this large and heavy wheel acquire a great velocity.

A vane, or fly, in machinery, has such a surface, that a too rapid motion is corrected by a resistance of the fluid it revolves in.

The composition and resolution of forces may be effected by the construction of a parallelogram, whose sides are the forces; and many forces may be combined in one resultant, or diagonal, by taking each pair separately, and using the resultant as datum for a new construction.—Or, the resultant, or diagonal, in force and direction, may be determined by adding the square of one force to the square of the other, then adding or substracting (as the forces are, or are not in the same direction) twice the product of the two forces by the natural cosine of the angle of their directions; and of this sum, extracting the square-root, which is the resultant force.—Then the angle of the resultant with the major force, is a division of the product of the minor or other force, by the natural sine of their angle, by the major force, added to the product of the natural cosine of their angle by the other force. The quotient is the natural tangent of the angular direction of the resultant, in relation to the first force.

Three forces, not in the same plane, are strictly the diagonal of a parallelopipedon, and may be so resolved by construction, &c.; or, they may be brought into one plane by multiplying the eccentric force by the cosine of the angle, which its direction makes with the plane of the others.

Two forces and their resultants may each be represented by the sine of the angle formed by the directions of the two others, as in the following formula:—

If F, f, represent two forces, and A the angle made by their respective directions; then the resultant

$$= \sqrt{(F^2 + f^2 \pm 2\,F\,f \cos A)}$$

And the angle with the force ·

$$= \frac{f \sin a}{F + f \cos A}$$

These propositions are of universal application by architects, mechanics, &c.

The following are the varied relations o forces; b the body, f the force, m the momentum, v the velocity, s the space, t the time. Then severally—

$$b \text{ as } \frac{m}{v}, \text{ as } \frac{f}{v}, \text{ as } \frac{m\,t}{s}, \text{ as } \frac{f\,t}{s}$$

$$f \text{ as } m, \text{ as } b\,v, \text{ as } \frac{b\,s}{t}$$

$$m \text{ as } f, \text{ as } b\,v, \text{ as } \frac{b\,s}{t}$$

$$v \text{ as } \frac{m}{b}, \text{ as } \frac{s}{t}, \text{ as } \frac{f}{b}$$

$$s \text{ as } t\,v, \text{ as } \frac{t\,m}{b}, \text{ as } \frac{t\,f}{b}$$

$$t \text{ as } \frac{s}{v}, \text{ as } \frac{s\,b}{m}, \text{ as } \frac{s\,b}{f}$$

It is the principle of *virtual velocities*, that if a system of bodies be in a state of equilibrium, in consequence of the action of any forces whatever, on certain points in the system; then if the equilibrium is for a moment destroyed, the small space moved over by each of these points, will express the virtual velocity of the power applied to it. And, if each force be multiplied into its virtual velocity, the sum of all the products when the velocities are in the same direction, will be equal to the sum of all those in the opposite.

Our moving powers, or first movers, are steam derived from air, currents of water, and wind, descending weights, the elasticity of air, and fibres of steel. We use, besides the muscular re-action of animals against the ground, which we deflect for special purposes, through the superior limbs of bipeds, and the alternate limbs of quadrupeds. In all, action and re-action are

equal, and we gain power on the patient by increasing the velocity of the agent; matter and velocity in agent and patient being always equal. The *primum mobile* is the two-fold motion of the Earth, and the rest are its deflections.

The Mechanical Powers for varying velocity may be reduced to three; but they are usually expressed as six, the Lever, the Wheel and Axle, the Pulley, the Inclined Plane, the Screw, and the Wedge.

In a single moveable pulley, the power gained is double. In a continued combination it is twice the pullies, less 1.

In levers, the power is reciprocally as the lengths on each side the fulcrum of motion.

The power gained in the wheel and axle, is as the radius of the wheel to the axle.

On an inclined plane, the power gained is as the length of the plane to the length of the base. The velocity, in descending to that, falling perpendicularly, is as the heighth to the length, and the force is the same. For a body acquires the same velocity as in falling perpendicularly through the heighth of the plane; and a body acquires the same velocity in falling down any number of planes, or down a curve, as perpendicularly from the whole heighth.

A body, moving down an inclined plane, moves 4 times as far in 2 seconds as in 1.

The power of the screw is as the circumference to the distance of the threads, or 6·2832 that distance.

The power of the wedge is as the length of the two sides to the thickness.

The diameter of the wheel of a pulley should be five times its thickness. The pin one-twelfth, and one-twelfth on each side allowed for play.

The most effective machines for saving and superseding human labour, now in use, are of American invention.

1. Dyer's Wire-carding Machine.
2. Wilkinson's Reed Machine.
3. Church's Nail Machine.
4. Fulton's Steam-vessel.
5. The new machine for preparing and spinning by one operation and movement.
6. Perkins's Engraving Apparatus.

The most perfect machines of British Invention have been—

The Steam-engine, in origin and progress, by 20 or 30 Patentees.

Hargrave's Spinning Jenny and Doffer.

Arkwright's Water or Steam-power Frames.

Crompton's Mules.

Cartwright's Power Looms.

De Jonge's Power Mules, &c.

Heathcote's Lace Frames.

Carpet Looms for all colours.

Cloth Cropping Machines.

Tilting, Rolling, and Slitting Mills.

Applegath's Printing Machines.

Babbage's Calculating Machine.

Apparatus for Grinding Lenses.

Avery's Steam-engine.

Ericsson's Rarefied Air Engine.

Saxton's Reciprocating Wheel.

Androides, to perform human actions, have been made in all ages. Bacon was said to make one to speak; and Albertus Magnus spent 30 years in making another. The Writing Androides is merely a pentograph, worked by a confederate out of sight. So also the Automaton Chess-player, and the Invisible Girl. They are, in general, constructed of wheel-work. Vaucanson, in this way, made a Flute-player; Kempelen, the Chess-player and Speaking Figure. Maillardet and Hancock many others.

Vaucanson made an artificial duck, which performed every function of a real one; even an imperfect digestion, eating, drinking, and quacking. A coach and two horses, with a coachman, footman, page, and a lady inside, were made by Camus, for Louis XIV., when a child. The horses and figures moved naturally, variously, and perfectly.

Cotton-spinning machinery, and manufacturing machinery in general, are merely varieties of the inventions of Androides, and toy-makers. A central power, with axles, wheels, cogs, ketches, ratches, straps, lines, levers, screws, &c. &c. variously combined, to reverse, direct, take up, drop, increase and decrease motion, constitute the wonders of Lancashire, Yorkshire, Derbyshire, and Warwickshire.

Till 1776, cotton-spinning was performed by the hand spinning-wheel, when Hargrave, an ingenious mechanic, near Blackburn, made a *spinning jenny*, with eight spindles, and having permitted one Peel, of that place, to view it as a curiosity, under an engagement of secrecy, Peel availed himself of Hargrave's invention, while Hargrave, on the report of the invention, had his cottage pulled down by a mob. Hargrave was obliged to remove to Nottingham, where he assisted Arkwright, but died in poverty. His last surviving daughter, the very one who worked the first jenny, was living in 1829, at Manchester, on a charitable stipend of 3s. per week, though the cotton manufacture, consequent on this invention, had yielded to Britain 1,000 millions sterling. Hargrave also erected the first carding-machine, with cylinders.

Arkwright's machine for spinning by water, was an extension of the principle of Hargrave; and he also applied a large and small roller to expand the thread, and, for this ingenious contrivance, took out a patent in 1769. At first, he worked his machinery by horses; but, in 1771, he built a mill on the stream of the Derwent, at Cromford. In 1772, his patent was contested, and cancelled in 1785, on the evidence of the widow and sons of Hargrave, who appeared to have been the inventor of the crank, so essential to the carding process.

In 1786, Crompton invented *the mule*, a further and wonderful improvement of this art. By its means, cotton is spun of a degree of fineness which never could be approached by the thumb and finger; and 200 hanks to the lb., each 840 yards, is its average performance, while 300 and 350 hanks are often produced. The number of hanks

is called the *number*, and, for different purposes, the lb. is spun from No. 6 up to No. 300; 30 being the average for hosiery, 200 to 280 for lace, 20 to 50 for calicoes, and higher numbers for muslins, &c. &c.

The largest spinning manufactories are at or near Manchester, and each employs from 600 to 1000 men, women, and children. The buildings are five or six stories high, filled with frames, each containing some hundred spindles, wrought in every part of the process by steam-engines.

The Mule, invented by Crompton in 1779, has now superseded the Jenny of Hargrave, of which it is such an extension, that 500 or 1000 spindles may be worked by it, and the finest weft be produced. Crompton called his machine a *Mule*, because Arkwright's spinning-frame used to be worked by a *Horse*-wheel, and it is intermediate between that and the *Jenny*. The number of mule-spindles is upwards of 8 millions in Britain.

The old-fashioned distaff furnished the idea of the most important of these new mechanical powers. One, the crank by which the reciprocating power of the steam-engine beam is transferred to wheel-work; and, the other, the different motion of the thumb and finger, in twisting the thread, imitated in the rollers of Arkwright.

Marshall estimates our mechanical power of machinery at 12, and its consuming power at only 1; and hence the miseries inflicted on labourers, for the manufacturers are not a seventh of the population, and their machinery supercedes the domestic labour of half the cottage population.

The Steam-engine, which confers on a piston the power of any number of horses, or 5 times their number of men, is the wonderful machine which has raised modern nations above their ancestors. Who ever invented it, it is now altogether English, and made what it is by our mechanics, and by successive additions to its facilities by Savary, Newcomen, Watt, and others. The Marquis of Worcester published mere projects, many of them very wild and absurd. As to the origin of steam-navigation and circular paddles, the Editor has seen an engraving of circular paddles, worked by oxen in an horizontal wheel, in a foreign book of 1510; and, with regard to the substitution of steam for oxen, it is not to be questioned that *Blasco de Garay*, a Spanish Captain, in 1543, made and exercised *a steam-vessel* in the port of Barcelona, but laid it aside, owing to the bigotry of an imperial officer But, the French refer the developement of the principle of gaseous expansion to *Solomon de Caus*, of Frankfort, in 1615.

Water is a very vapid fluid, yet, when heated and converted into steam, it is the most powerful of all substances; or, when frozen, or when melted, it tears rocks in pieces, and splits the largest trees. Its power of action is therefore derived from various degrees of heat, while its facility of re-action, by sudden condensation, makes it so efficient an engine of power. It raises a piston by its expansive force, and as readily lets it fall again by the simple introduction of a jet of cold water. This double facility of receiving, and parting with power, renders its agency so important.

If from 275 to 450 grains of water are, in the same time, made into a cubic foot of steam, they act with a force of 16·27 lbs. per square inch.

We, however, use the powers of steam, without knowing the source; but the spirit of a philosopher will lead him to inquire, whence so extraordinary a force proceeds? First, he will perceive, that it is derived from the action of the fire on the water. He will then inquire, why fuel in combustion transfers so extraordinary a degree of force—and will find that a current of air is necessary. Then, by inquiring into the constitution of air, and its effects on the fuel it will be evident, that *the air* itself contains the primary element of this great force. All that intervenes between it and the effect of the engine, is *merely a series of means* for transferring and displaying the energy of the air which feeds the fire, which converts the water into steam, which re-converts it into water, gives out its steam-power to the piston, and this to the beam, &c. &c. In fact, all that is changed is the air, which has lost its oxygen in the fire, where the oxygen has been fixed and concentrated by the evolved excited hydrogen of the fuel. In fact, air has fed and sustained the ignition, and in parting with its motion, and becoming fixed, its atomic motion, as heat, has been simply transferred to the water, whose susceptibility and density display the force by lifting the piston, the beam, &c., and by its susceptibility of parting with its motion to cold water thrown into it, re-condenses, and lets the piston fall again.

This is the general principle, and the variations are a volume of steam applied above the piston, to drive it down with increased force, and a separate vessel for the refrigeration.

Shut up the ash-hole, and you stop the engine,—consequently, the whole force is the motion which was in the air itself when it passed to the fuel. That motion is there *fixed*, but not lost; for it is transferred to the boiler, and by the boiler to the atoms of the water. Thus these atoms are enabled to overcome the previous pressure of the air, by a projectile force greater than 15 lbs. to the square inch, and being projected and re-acted on by the aerial pressure, the two forces turn them into *orbits*, whose size is in proportion to the excitement, and consequently is the expansive force.—*Editor*.

A single bushel of coals will raise 97 millions of lbs. one foot, and in ordinary 90.

The cylinders of the engines employed to drain the Cornish mines, are 7½ feet in diameter, or 350 horse-power, and raise from 45 to 75 barrels of water per minute. The whole in Cornwall are equal to 44,000 horses, reckoning each horse at 1-16th of a bushel of coals.

Wheal Abraham mine is 1452 feet; Dolcoath, 1410 feet; and Gwennap, 1740, or the third of a mile in depth.

Horse-power is reckoned as constant, but if they work but 8 hours a day, a 100-horse engine is equal to the work of 300 horses.

Horse-power in steam-engines is calculated as the power which would raise 33,000 lbs. a foot high in a minute, or 90 lbs. at the rate of four miles an hour.

One-horse power is equal to the lifting by a pump 250 hogsheads of water ten feet high in an hour. Or, it will drive 100 spindles of cotton-yarn twist. Or, 500 spindles of No. 48 mule-yarn, or, 1000 of No. 110, or twelve power-looms. One-horse power is produced by 16 lbs. of Newcastle coals; 50 lbs. of wood, or 34 lbs. of culm. Coals 1, wood 3, and culm 2, give equal heats in the production of steam. In other words, these combustibles fix oxygen in the inverse ratios of 1, 2, and 3.

1584 gallons; a cylinder 14·2 inches; ten horses; fifty men; or 56·57 feet Dutch sails, are equal to raising 1000 lbs. 130 feet in a minute.—*Fenwick.*

By the steam-engine, one bushel of good coals raise from twenty-four to thirty-two millions of pounds one foot per minute. Four bushels of coals per hour, with a cylinder of 31½ inches, and 17½ strokes of seven feet per minute, is a force equal to forty horses constantly. A rotative double engine, with a cylinder 23·75 inches, making 21·5 strokes of five feet per minute, is a twenty-horse power; and a cylinder 17·5, making 25 strokes of four feet, is a ten-horse power; the consumption of coals being proportional.—*Watt.*

By Parke's system, 10 lbs. of water is evaporated at 212° by 1 lb. of coals; 7½ lbs. of water is usual for 1 lb. of coals. Parke's boiler has 10 square feet of surface instead of the usual 7½ and 5 feet.

A cubic foot of steam, at 212°, is produced by a cubic inch of water, *i. e.* steam is to water as 1800 or 1728 to 1.

The piston of a steam-engine works twice the length of the cylinder at each stroke; and at a maximum, in a 9-feet stroke, 14 per minute, travels 250 feet, or with a 6-feet stroke, at 21 per minute, 210 feet.

The effective force of a piston is taken at 10 lbs. per square inch, or two-thirds of the atmospheric pressure, and is of course ten times the square inches in lbs. This force, by the number of feet the piston moves per minute, is the momentum, or lifting-power per minute.

The momentum, or lifting-power per minute, divided by 33,000, a one-horse power, is the number of horses equal to the engine.

The nozzles of safety-valves are one-fifth that of the cylinder.

The powers of the steam-engine have been directed to every variety of manual labour. Its reciprocating motion is so readily rendered circular, that wheels, straps, &c. perform every desirable operation, great or small, with unerring regularity. There is power from 500 horses to 1, capable of being directed and modified, concentrated or divided. Hence, there is no object of labour which it does not, or may not effect.

The most powerful steam-engine, in England, is that erected at Hawkesbury Colliery, near Coventry. Its cylinder is 58 inches in diameter; the piston moves 8 feet in a stroke, and makes 12 strokes in a minute; the pump is 14 inches in diameter, and the lift is 65 fathoms.

The steam-engines, in Cornwall, use now but 1 bushel of coals for 16 used 30 years ago.

At the United Mines, in Cornwall, 11,000 bushels of coals, of 94 lbs. each, were used with 1,200,000 imperial gallons of water; as 1 to 121, or 1 bushel of coals to 16 cubic feet; others make it average 1 to 14.

Explosions in steam-engines arise from the fire rising above the level of the water, and generating hydrogen, which is exploded by atmospheric air derived from the neglect to keep the feed-pump surrounded by water.

Water is the best conductor of heat upwards, and the worst conductor downwards.

Iron, at a white heat, keeps water at a distance, and generates less steam, as 1 to 15, than a lower temperature, called the evaporating point.—*Perkins.*

Antharcite, or Welsh stone, is best adapted to steam-boilers.

Tabular Boilers are free from all danger, and if a tube bursts, it is scarcely perceived by bye-standers, while its place can be instantly supplied by spare ones. They are used in all locomotive engines.

Weaving is performed by stretching threads generally horizontally, called the *warp;* and then raising or depressing certain portions of the warp-threads by treddles, so as to pass between them a thread called the *weft*, by means of a *shuttle*, to which the *weft* is fastened.

The fly-shuttle was invented by John Kay, who, in consequence, fled to France.

The reed for weaving in England is counted by parts of 36 inches. In Scotland and Ireland, by parts of the Scotch ell, 37 inches; the Dutch, 40 inches; and the French, 34 inches; so that 100 of Scotch and Irish is equal to 92 French, 108 Dutch, and 103 English.

Women originally spun, wove, and dyed; and the origin of these arts is ascribed, by ancient nations, to different women, as women's arts. The Egyptians ascribed it to Isis; the Greeks to Minerva; and the Peruvians to the wife of Manco Capac. But in China and India it is still more ancient.

In Schulze's experiments on human strength, he found that men of five feet, weighing 126 lbs., could lift vertically 156 lbs. 8 inches; 217 lbs. 1·2 inches. Others 6·1 feet weighing 183 lbs.; 156 lbs. 13 inches, and 217 lbs. 6 inches. Others, 6 feet 3 inches, weighing 158 lbs.; 156 lbs. 16 inches, and 217 lbs. 9 inches. By a great variety of other experiments, he determined the mean human strength at 30 lbs. with a velocity of 2·5 feet per second, or it is equal to the raising half a hogshead 10 feet in a minute.

Most authorities rate one horse as equal to five men, some at six, and the French at seven. Porters carry from 150 to 250 lbs. A man draws horizontally 70 or 80 lbs, and thrusts at the height of his chest 28 or 30 lbs. In hot climates, men cannot perform half the continued labour

A man's mean labour, per Young, is sufficient to raise 10 lbs. 10 feet in a second, for 10 hours per day, or, 100 lbs. 1 foot in a second, or 36,000 feet in 10 hours; that is, 100 lbs. per day would be 3,600,000 lbs. 1 foot in a day, which he calls a dynamic unit.

A man, unloaded, can walk 3½ miles per hour for 10 hours, without prejudice. That is, 308 feet per minute, or 5 per second. His most useful effort is to raise half a cubic foot of water 2 feet per second.

Bricklayers ascend ladders with loads of 90 lb. 1 foot per second.

The force of a horse, per Desagulier, is 44,000 lbs. 1 foot per minute.

Per Smeaton, 22,916 ditto.

Per Watt, 33,000 ditto.

Then, as Mr. Watt, in a steam-engine, considers one-fourth lost by friction, he takes Desagulier's 44,000 lbs. as the horse-power in his steam engine.

A man or horse will perform his labour with the greatest advantage, when the resistance is four-ninths of his natural strength, and when his velocity is equal to one-third of his greatest velocity when not impeded.

The force of a man at rest is about 70 lbs. and his velocity six feet when not impeded, therefore his force is exerted to the best advantage by a resistance equal to 31 lbs. and a velocity of 2 feet per second. So with a horse, his greatest pull is 420 lbs., equal to 20 cubic feet of steam per minute, and his rate 10 feet a second, therefore his labour is best performed at 187 lbs. and 3 ft. 4 inches per second.

Smeaton, a good authority, reckoned a horse equal to 5 men, and Bossuet seven men, and an ass to two men.

A horse, says Desagulier, can draw 200 lbs. 2½ miles per hour, for eight hours per day, or 243 lbs. six hours. Smeaton says, that a horse loaded with 224 lbs. can travel twenty-five miles in seven or eight hours.

A horse will draw 200 lbs. for eight hours, at 2½ miles an hour; and the strength of five men is equal to one horse. According to work or position, a horse can perform the work of seven men, or only of three men, but 5½ is taken as the mean.

The force of a man in turning a winch is taken at 116 lbs., or as much as would raise 256 lbs. 3281 feet in a day; his force in pumping is as 190, or equal to 419 lbs. in 3281 feet; in ringing 259. or 572 lbs. in 3281 feet; and in rowing 273, or 608 lbs. in 3281 feet. In working a pump, a winch, a bell, and rowing, the effects are as 100, 167, 227, and 248.

A man with an augur exerts a force of 100 lbs., with a screw-driver of 84 lbs., with a windlass 60 lbs. A hand-plane 50 lbs A hand-saw 36 lbs.

In sawing stone, the labour on calcareous stones is as 45 to 60, on granite as 500 to 700, and on red and green porphyry 1200.

Hatchett's Dynamic Unit is 1·3124 hogsheads, raised 10 feet. The Unit of Transport is 2208 lbs. 3281 feet.

COTTON.—The application of Machine-power to this fibre led to its extension to all others, and brought mechanism into general request. It can only be understood by being seen, but the general principles of all are the same. The various mills employ 4000 machinists, engineers, and millwrights; and not a month passes without improvements to save the expence of manual labour. Altogether there are, in the United Kingdom, about 1282 cotton factories which employ 220,000 hands, of whom ⅛th are under 13, and about half above 18.

England contains	1080
Wales	6
Scotland	166
Ireland	30
	1282

So that these employ, on the average, 172 hands. They have, besides, 1050 steam-engines, and 500 water-wheels, which, at 25 horse-power to the former, is 26,250 horses, and at 12 horses to each water-wheel, is 6000, or 32,250 together. Hence, at a mean of 5½ men to a horse, the machine power is equal to 177,375 men. Taking, then, the 220,000 men, women, and children, at half the power of men, we have, in this manufactory, a total force equal to that of 287,375 men.

The weavers, dyers, &c. in connection with spinners, are about ..	75,000
Cleaners and spreaders ..	5,200
Carders	44,000
Mule spinners	70 000
Reelers	16,000
Roller coverers	8,000
	218,200

So that 143,000 spinners, &c. produce about 250 million lbs. of yarn and twist, or about 1700 lbs. each, or about 5½ lbs. per day each, assisted by steam-power equal to 177,375 men.

WOOLLEN.—There are about 1313 factories in the United Kingdom.

London district	19
Leeds ditto	378
Halifax, &c.	157
Gloucester	118
West of England	140
Lancashire	106
Wales	85
Scotland	104
Ireland	46
Huddersfield, &c.	160
	1313

They employ about 72,000 hands, or 55 on the average, half above twenty, and nearly half females. The process includes a score of manipulations, much heavy and ingenious machinery, and 560 steam-engines, and 480 water-wheels.

The domestic wool trade, much reduced, is supposed to employ as many more, besides blankets, hosiery, &c. about half, or altogether 180,000 men, women, and children.

The wool for all fine and second cloths is Saxon, with some Spanish and Colonial. British wools will not mill, and are used for flannels, blankets, and worsted purposes.

HEMP and FLAX.—The spinning and weaving of hemp into sail-cloth and sacking, and of flax into linen, cambrics, &c. employ 347 factories.

London	6
Leeds	35
Scotland	175
Ireland	41
Other parts	90
	347

They employ, by returns, about 33,500 hands, or 97 on the average, two-thirds men and boys. Dumferline alone employs 8,000, and Dundee 3,500. In Ireland the Domestic system still chiefly prevails, but is fast diminishing. This fabric employs about 60 steam, and 60 water engines, in various manipulations.

SILK.—We have in the United Kingdom about 250 throwing-mills, with 1½ millions of spindles, which employ about 7000 men, 5000 children, and 19,000 women and girls. They are aided by 130 steam-engines, and 60 water-wheels. The trade has risen in consequence of Jacquard's improved machinery.

In and near London	31
Nottingham, &c.	22
Leeds	2
Scotland	6
Lancashire, Cheshire, Coventry, &c.	189
	250

So that altogether our mechanics, engineers, and patentees, have employment in,—

Cotton Factories	1282
Woollen	1313
Hemp and Flax	347
Silk	250
Fibrous Manufactories	3192

And we have in them,—

	Steam Engines.	Water Wheels.	Equal to Man's Power.
Cotton	1050	500	177,378
Woollen	560	480	103,180
Hemp, &c.	60	60	12,210
Silk	130	60	21,835
	1800	1100	314,600

Hence it appears that the mechanical powers applied in our Fibrous Manufactures, are 1800 steam-engines, and 1100 water-wheels, equal in force to 314,600 men, at 137½ men to every steam-engine, and 66 men to every water-wheel.

And that the same factories employ 143,000 in cotton, 72,000 in woollen, 33,500 in hemp and flax, and in silk 31,000. As operatives, men; women and children about 279,500, with supernumeries, &c. perhaps 300,000.

The cotton-spindles in England are nearly 10 millions, in France nearly 4, in the United States about 2, and in Switzerland half a million.

Formerly linen warps were worked with cotton wefts, and cotton warps were first used about 1765.

In cotton-factories Kay estimates the cost of machinery, buildings, &c. at £500 for every horse power.

A lea of linen yarn is 300 yards, and lbs. are spun as fine as 50 leas, or 15,000 yards; but Nos. 30 and 40 are the average. A hank of cotton thread or twist is 840 yards, from Nos. 10 to 350.

Lace weaving-machines being complicated, are very expensive, costing from 4 to 800*l*. each, and yet liable to be superceded by improvement. There are about 1000 proprietors, who let them to operatives in this increasing trade.

The social importance of the Cotton Manufacture will justify a few observations on its origin, and the first invention of the improvements, founded partly on the personal knowledge of the Editor:—

In 1600, cotton was first brought from Cyprus and Smyrna, and made into fustians, dimities, &c. In 1697, two millions pounds were imported for weft, to work with linen warp as a domestic manufacture, the carding and spinning being performed by children and women for rural weavers.

Between 1743 and 1750, the quantity fluctuated between one and two million pounds. In 1742, one Wyatt took out a patent for spinning *with rollers*, and set up a mill at Birmingham, worked by two asses and ten girls. He failed, and it was then unsuccessfully tried at Northampton. In 1767, Hargraves, a carpenter, near Blackburn, to facilitate the work of his children, invented the spinning *Jenny*, first for 8 threads, and afterwards for 20 or 30. In 1768, Hargraves shewed the Jenny to Peel, of Blackburn. In 1769, on Peel's speaking of it, a mob of distaff spinners destroyed Hargrave's house, and, in 1770, Hargrave removed to Nottingham with Arkwright, who had bought the principle of double rollers of one Keys, who had obtained it from Highs. In the same year, Hargrave and Arkwright, for want of a steam-engine, contrived the water-frame, and Hargrave invented the Doffer-crank. In 1771, they wanted capital, and their partnership was dissolved; but, in 1773, Needs and Strutt joined Arkwright. In 1774, Hargrave died poor at Nottingham, and in 1785, after twelve years enjoyment of the patent for the water-frame and horse-frame, with immense profits, the patent was set aside on the evidence of Hargrave's son, as his father's invention.

In 1786, Crompton's *Mule*, for making weft, was invented, an improvement on the *Jenny* and *Horse*-frame, but it was obstructed in use by Arkwright's patent. It spins a pound of cotton into 300 and 350 hanks, of 840 yards each, or 143 and 167 miles, and it perfected the other inventions.

Arkwright's spinning-frame was used chiefly for warp, and Crompton's Mule for weft, but Crompton died in poverty, the £5000 voted to him by Parliament, in 1812, not defraying debts incurred during the invention!

The Power-loom was invented by the Rev. Dr. Cartwright, brother of the patriotic Major, in 1787, for which he obtained a parliamentary grant of £10,000. It enabled the weaver to make into cloth the overwhelming quantities of machine-spun warp and weft. They are now extended to cotton, woollen, silk, and flax, in the proportion of 109, 5, 1 7 and 0·3.

In 1829, after 10 millions a year had been gained for 50 years, by the manufactory under these inventions, Sir Richard Phillips found the aged daughters of Hargrave at Salford, subsisting on a charitable endowment of 3s. per week, obtained for them by the kindly feelings of Joseph Brotherton.

On the disputed point, whether the application of *the thumb and finger principle* was due to Highs, Kay, Hargrave, or Arkwright, the Editor of this volume (who knew most of the parties) was often told by Livesay, a barber, and fellow-apprentice of Arkwright, that "*Dick*," as he called him, "had £100 coming to him when out of his time; but, instead of setting up as a barber, he bought a mechanical secret of one Kay, a watchmaker, who had been employed by one Highs to make a machine, which he sold to Arkwright, because Highs could not pay him." On the other hand, Mr. W. Strutt, of Derby, who knew Arkwright well, told the Editor that these were fictions, for Arkwright was a superior man, and perfectly competent to invent for himself. Again, the daughters of Hargrave gave the Editor various proofs that the whole originated with their father, who lost his advantages, by permitting the inspection of "Master Peel."

Be this as it may, the original parties gained millions, and died the greatest capitalists, and richest subjects of any age; and the progress of this, and kindred fibrous manufactories, have been the most extraordinary phenomena in the history of society.

The cotton trade employed, in 1834, 110,000 power-looms; the woollen nearly 2200; the worsted 3200; the silk-weaving 1714; of the linen 309; in all nearly 116,000, which, in 1838, are full 160,000

France employs 1700 steam-engines with 22,500 horse power.

Heathcote, of Tiverton, has applied the steam-engine to the plough, &c.

Avery's rotatory steam-engine derives its power from the reaction of escaping steam, like Barker's mill. The steam escapes from a hollow horizontal tube of 2½ feet to 6 feet radius. This reaction against the air produces a rotation from 3000 to 1000 times in a minute, and a pinion in its axis serves to turn a spur-wheel for work of any kind. The steam may be 4 or 8 atmospheres, and it escapes from an orifice of only the fourth or eighth of an inch. It works with such facility as to save the two-fifths friction lost in the reciprocating engines of Bolton, Watt, &c. Avery's engine, of 15-horse power, weighs but 500 pounds, and consumes 500 gallons of water and a ton of coals in 12 hours. One of 5-horse power performed the heavy work of a large establishment.

Other important applications of steam power, in late years, have been made to steam navigation and the locomotive engines on rail-ways, for which, *see the Articles* NAVIGATION *and* INTERCOURSE.

Donkin's velocity cup is nearly filled with mercury, and, by revolving, the surface becomes concave, and elevates or depresses the fluid in a tube, which becomes a guage of velocity in the works which move the cup.

It has long been a question, whether machinery is, or is not beneficial. The arguments are as under:—

In favour of machinery.

1. That it produces cheaper than by hand.
2. That it produces more uniformly.
3. That it produces required quantities in fixed times.
4. That it employs more hands.
5. That it brings more capital to bear on operations.
6. That it promotes sales in foreign markets.
7. That it represents the march of science and discovery.

Against machinery it is urged:

1. That it supercedes human labour, and deprives thousands of families of their hereditary domestic employments.
2. That the numbers of operatives are increased only at the seat of manufacture.
3. That it pays the manual labour which it employs inadequately, and thereby alone sells cheaper.
4. That the foreign monopoly will last no longer than foreigners are without the same machinery.
5. That capitals are only concentrated, not increased. While the concentration reduces the operatives to irremediable slavery.
6. That when domestic manufactures were annihilated, no system of liberal policy, as to land and poor-rates was adopted, to provide for those who lost their subsistence.
7. That the concentration of numbers is inimical to moral improvement, and destructive of domestic comfort and social happiness.
8. That the benefits of science and discovery ought to be enjoyed by poor as well as rich, and if the powers of nature are made to supersede manual labour, then all men ought to enjoy as much with less manual labour, or more with the same labour.
9. That discovery and increased production are not objected to, but the misdirection of the advantages, which, instead of being divided, are monopolized.
10. That the untirable steam-engine ought to be no test of daily hours of labour, and that human powers ought not to be exhausted by concert with it, in a hopeless existence of stultifying slavery.

11. The chief mischief of machinery has been the ignorance, or cruel indifference of legislation, to those whose employments it has superceded.

Water-mills are an ancient great means of power. They are *undershot*, *i. e.* carried round by a current in which the floats dip; and *overshot* when the water from above falls upon the floats. Till the steam-engine, these and windmills were our only inanimate powers.

The circumference usually moves from 2 to 6 feet per second, and the wheels are from 20 to 40 feet diameter. The water falls about 1.7th beyond the top.

Windmills are also a great power. The force of wind, at 10 miles an hour, is half a pound per square foot; at 14 miles is a pound; at 20 miles, 2 pounds; at 25 miles, 3 pounds; at 35 miles, is 6 pounds; at 45 miles, 10 pounds; at 60 miles, is 17¾ pounds; and at 100 miles, is nearly 50 pounds. To give the fullest effect to this force, the sails are inclined to the axis from 72° to 75°. The tips of the sails often move 30 miles an hour. From tip to tip is about 70 feet, and the breadth from 5 to 6 feet.

Windmill-sails move 30 miles an hour, or 44 feet per second.

If windmill sails are inclined to the wind from 60° to 80°, the effect is 6-7ths the force of the wind.

The velocity of the wind, per second, is to the turns of the sails, per minute, as 5 to 3. The effect is a sixth of the force of the wind, or generally equal to 11 horses at a walking-wheel. In a mill, observed by Coulomb, with wind at 20 miles an hour, or 30 feet per second, the sails, each 34 feet, made 17 turns per minute.

Pumps are machines which demonstrate the pressure of the atmosphere, by raising water into a vacuum, from 32 to 34 feet, according to the state of the air. It rises 13½ higher than mercury in the barometer, water being to mercury as 13·568 to 1, and the cause of the ascent of each being the same.

Pumps were of ancient invention, but the ascent of the water was ascribed to suction, a power as ridiculous as attraction, &c. Torricelli discovered the true cause, and then made the barometer. The forcing has a solid plunger, with acting valves beneath and at the sides. —*See* METEOROLOGY.

The hydraulic ram raises water through a valve, by the lateral action of a current within a pipe. It rises in an air vessel, and the reaction of the air forces the water up a tube placed in the water.

Blowing-machines, for iron smelting, have lately been invented by Street, to give a constant blast of 1200 cubic feet per minute. The effect is as the quantity and density of air. Previously-excited or hot-air has also been used with reported good effect for the same purpose, and it is said to improve the iron while it accelerates the fusion.

In complicated machinery, steam-engines, &c., friction is one-third or two-fifths of the force; unless diminished by gurnetts, or other friction-wheels.

Friction is the parting with motion, or force, to surfaces in contact with the mover; and resistance is the parting with motions to the atoms of any medium through which a body in motion is passing.

Friction varies with the nature of the surfaces rubbed, and with the weight, or downward force of the mover.

Ferguson found that the friction of soft smooth woods was a third of the weight; rough woods, half; soft on hard, a fifth; steel on steel, a quarter; steel on brass, a sixth.

Coulomb determined that it increased with time of contact, and varied between half and a quarter the weight. It varies little from extent of surface or velocity.

Gun-metal against steel has but two-thirds the friction of cast-iron against steel.

It is the friction of twisted fibres that gives strength to all fibrous substances.

It checks all great natural motions, by carrying off their excess.

Resistance is a case of parting with motion, by its transfer to media through which a body passes. It depends of course on the density and viscidity of the medium. In air it is so great, in great velocities, that a ball which leaves a musket with a velocity of 1670 feet per second, and which, by the parabolic theory, ought at an angle of 45° to go 16 miles, goes but half a mile. And a 24-pound ball, which, with 16 pounds of powder, ought to range 16 miles, goes less than 3 miles; and, another 5·6 inches in diameter, with an initial velocity of 1640 feet, ranges but 1½ mile.

An iron ball 3 pounds weight, or 2·78 inches diameter, thrown with a velocity of 1800 feet, is resisted with a force of 176 pounds, and a ball 1·05 pounds, with a velocity of 2000 feet, will ascend but half a mile; and, if in vacuo, it ought to go 11¾ miles.—*Hutton*.

Balls ascend when directed horizontally, because their velocity is greater than the Earth's rotation, and for the instant they lose the force of gravity, or weight. Balls also range further when fired from West to East, in the direction of the Earth's motions, and the same affects a race-horse.

Cannon-balls moving 1600, 1200, 1500, and 1060 feet per second, or near the mouth of the gun, penetrated elm 20 inches, 15, 30, and 16 respectively; oak at 1200, 34 feet; and earth at 1300, 15 feet. The balls were from 2 inches to 5½ in diameter.

In sandy soils, the greatest force of a pile-engine will not drive a pile above 15 feet.

A 32-pound rocket, sent up perpendicularly at Shooter's Hill, rose 6000 feet, and was seen at Deal. A 24-pound rose 4500 feet; a half-pound, 2400 feet; and a quarter-pound 1500 feet. The object was to determine the longitude on Whiston's plan.

Owing to the centrifugal force, it is easier to do feats of horsemanship in a small ring, as at theatres, than if the animal were running on a straight road. The man and horse always inclining inwards, to counteract the centrifugal force, and if the rider tend to fall

inwards, he has merely to quicken the pace; if to fall outwards, he has to slacken it.

Men working at the Tread-Mill ascend nearly half a mile an hour.

The largest battering-rams of the ancients were equal in force to a 36-pound shot from a cannon.

Aaron Raschid, in 802, sent from Bagdat, among other presents, to Charlemagne, a clock of curious workmanship. The first clock, with a balance, was made by De Vick in 1364, and the first pendulum clock was made in 1641, for St. Paul's, Covent Garden. Franklin and Ferguson made clocks with only 3 wheels, and 2 pinions. Watches, with springs, were first made at Nuremberg, about 1477, but Dr. Hooke, the inventor of the Principles of Physics adopted by Newton, was the first who applied a spring to a watch, in 1658.

The beats in an hour of a common second's clock are 3600, and 17,280 a common watch; but seconds watches beat 18,000 times, or 5 per second.

Chronometers, for nautical and astronomical purposes, are now made with such precision, that they do not vary from true time more than 2 or 3 seconds in a year.

The best watches and timepieces are made in London, but many at Liverpool and Coventry, also at Paris and Geneva. The first decided improvements were by Harrison, Arnold, and Earnshaw, each of whom received rewards from Government. Brequet is the most skilful maker of nautical time-pieces in France.

Two prize chronometers, in 1825, varied in 12 months but 1″·8 and 1″·85. The extreme variation of two watches at Greenwich, in 12 months, was ·9″ to 2·8′ in temperatures from 39° to 82°. The mean daily variation of the Greenwich transit clock, in 6 years, is 3·9″.

The wheel work of watches is chiefly made at Prescot, and some villages near Liverpool, and then fitted and put together by makers at London, Coventry, &c. The Goldsmith's Company assay 100,000 per annum. Those assayed out of London are about 150,000, making a gross return of nearly a million and a half on the 250,000. They employ nearly 10,000 hands, and nearly 3000 live by this trade in Clerkenwell and St. Luke's parishes, where the most perfect chronometers are made.

One of the most useful mechanical contrivances is the pendulum for measuring and equalizing time. It is an effect of the centripetal force created by the Earth's motions, and its results are referrable to them.

A pendulum which vibrates seconds of time at the sea-level, in the lat. of London, must be 39·1393 inches, or 3 feet 3·139 inches long. It varies as the square of the time required; that is, in half a second it must be a 4 h, or 9 7848 inches; in a quarter of a second, a 16th. In two seconds, 4 times.

It varies too in different latitudes, owing to the oblate figure of the Earth, for since the inverse force is everywhere as the sum [illegible] of the sine and cosine of the latitude, and the sines are short at the poles, so the inverse force is less at the poles and the approach to them. The lengths are 39·011684 at the Equator, but by calculation 39·11682 at the Poles.

Observations, the nearest to the Equator, make it 39·02069, 39·01197, and 39·01717; and others above lat. 70, make it 39·19512, 39·20328, and 39·21464.

Lat. 45 gives 39·11682.

Lat. 34, gives 39·076[illegible]6.

The same pendulums at London and Paris, made, at London 85945·85 and 85933·29, and at Paris, 85933·83 and 85922·06 vibrations in a mean solar day, being 12 more at London than Paris, and proving that they ought to have been longer at London.

The length of the second's pendulum is the quotient of twice the fall of a body in the first second, by the square of 3·1416.

The length of a second's pendulum every where, is the fall in a second into 0·20264. And the fall in a second is 4·9348, the length of the second's pendulum.

Owing to the shortness of the sines in the oblate spheroid, the weight of the same body is different in different places, that is, as the lengths of the pendulum; consequently, if at the Equator a body weighs 39·011684 lbs., it would weigh at London 39·1393 lbs.; at lat. 45, 39·11682; and at the Poles, 39·221956 lbs.

The proportion of seconds to 100 vibrations, in any pendulum, is the multiple of the square-root of the length, by 16·112.

A pendulum of 4·3 inches, vibrates three in a second, of 17·3 inches in 2.3ds of a second, of 25 inches 4-5ths of a second, of 27·1 inches, 5-6ths of a second.

39 inches gains a second in every 1000, and 39·2 loses 7 seconds in every 10,000.

193 inches is commonly taken as the fall of a body, per second, in London, but at the sea-level, Kater made it 193·1445 inches, or 16·095375 feet. By this last, the second's pendulum is 39·1393 inches.

A leaden ball fell from the cupola of St. Paul's to the pavement, 272 feet, in 4·25″, which squared, is 18·06; then $\frac{272}{18\cdot06} = 15$ feet per second. But 17 feet being allowed for resistance, it is taken as $\frac{289}{18\cdot06} = 16$ feet per second in air; and as 16·08 in vacuo. A hollow glass globe was 6″ in falling the same height.

The time of a complete oscillation in a cycloid is to the time a body would fall through the axis, as 3·1416 to 1. Then the fall of a body in a second is 3·1416°, × half the length of a seconds pendulum.

Oscillations of pendulums are equal only in small arcs, or in cycloids.

The time of falling through the chord of a circle is equal to the time of descent through the diameter; and through all arcs of a cycloid are equal.

Arcs of circular vibration of 30° increase the time 0·01675, of 5° the 12-100000th, and of 2½° the 3-100000th.

In small arcs, the vibrations of equal pendulums are performed in the same time.

The times are as the square roots of the lengths. The lengths are as the squares of the number of vibrations in the same time.

An elastic pendulum, vibrating between semi-cycloidal cheeks, performs all its arcs in equal time. Compensation, or gridiron pendulums, are formed of steel and brass alternately, so as not to vary in length by temperature.

A gridiron pendulum is 5 rods of steel and 4 of brass, whose varied expansions by heat correct each other. Mercury in a glass tube has been used for the same purpose. Reid's pendulum of a zinc tube below the ball is excellent.

Velocity and chords in a pendulum are as the square-root of the versed sine.

A given velocity of collision may be given to any body, by allowing it to fall as a pendulum from the perpendicular heighth, which gives the force. This is effected by dividing the square of the proposed velocity by 64·34 for the heighth which it must fall. Thus, if we want a velocity of 10 feet, $\frac{100}{64} = 1{\cdot}56$ is the heighth, allowing for friction.

In the hydrostatic balance, in Bramah's pressing engine, (independently of his forcing pump) the force is to the weight of water in the pipe as the area of the surface acted on is to the area of the orifice of the pipe.

A dredging-machine raises in its buckets, in four hours of each tide, 960 tons of gravel per day; or, on a clay bottom, about half that astonishing quantity.

A pin-making machine has been set up at Stroud, which makes pins with solid heads, from the wire to the polishing, without the interference of the hand. A water-wheel, of 40-horse power, works 100 several machines, which produce 4500 pounds of pins per week, or 19 millions of pins.

Sepping's diagonal trussing saves £2080 value of timber in a 74. The price is £10,420 instead of £12,500.

The life-boat was invented by Henry Greathead, of South Shields, in consequence of a premium being offered for the object. Its principle is such an elevation of the two extremities as that, if overset, these elevated ends would be as light as the body of the boat; and, to add to the effect, several pounds of cork are attached to the ends. The shape of the boat is curvilinear, approaching that of a crescent.

The life-buoy used in the Navy consists of two hollow copper vessels balanced by a mast fitted with shifting lead, and with ropes to hold by. It is ingeniously let down in case of persons falling over-board, and in the night provided with port-fire.

That important instrument the anchor consists of the ring, the shank, the flukes, and the stock. The flukes consist of the palm, and the bill and the stock is the beam at right angles to the fluke, which, lying horizontally, causes the bills to fix in the ground. Anchors for the navy weigh from 1 cwt. to 90.—In the first, the shank and stock are 5 feet 8 inches each, and the fluke 1 foot 10 inches. And in the largest, the shank and stock are 20 feet each, and the fluke 6 feet 8 inches. The cost of the largest (called the bower-anchor) is £418; and every first-rate has four. In 36-gun frigates the bower-anchor weighs 40 cwt., and costs £115. In seventy-fours they weigh 70 cwt., and cost £285. Every man-of-war has four bowers, 1 stream, about a fourth of the weight, and 1 kedge.

The great block-machine unites the action of 16 different machines in 1 steam-engine—7 for the shell, and 9 for the sheave. 10 men do the work of 110. It makes about 200 sorts and sizes of blocks:—*i. e.* 72 sizes of thick blocks, 48 of thin blocks, 10 of clue-line ditto, 20 sister blocks, 20 topsail ditto, 24 fiddle ditto, 20 jack ditto. Of which varieties, the machines make 1420 blocks per day.

A seventy-four gun ship requires about 1300 blocks, and there are 200 different sorts and sizes, varying from 4 to 28 inches in length. Every gun requires 6 blocks.

Phillips's capstan gives a quadruple power, and works the chain pumps.

Iron cables are now commonly used in the navy.

Carding wool by hand, previous to 1800, used to employ many thousand wool-combers; and the preparing and inserting the wires, many thousand women and children; but combing, both of cotton and wool, has for some years been performed by rotating machinery, and the cards are made by Whittamore and Dyer's American machine, with astonishing celerity.

Three feet per second is the common velocity of overshot water-wheels. But the wheels of steam-engines move from 5 to 12 feet per second, and make from 20 to 40 revolutions per minute.

Casks have lately been made by Brown's machinery, which produces 300 with the manual labour previously expended on 80.

Brunell's saw-mill at Chatham, with a 36-horse engine, with 10 or 12 hands without horses, performs the labour of 50 saw-pits. It takes the timber from the vessels, and delivers the sawn planks to the stacks.

By the machinery at Weevil, Portsmouth, 8 men and 2 boys manufacture 90 cwt. of biscuit in an hour and a half; less time than 10 men manufactured 36 cwt.

In 1811, the printing-machine was invented by Koenig; it perfects 900 sheets in an hour; Applegath's 1000.

Rollers for distributing ink on types are made of glue and treacle.

Inking types, in press-work, by balls, consume above double the ink that is used in printing-machines.

The increased power of the *Stanhope Press* is produced by the crank, called a *Toggle*, or knee-joint.

Locks have been made with twenty-four moveable wards, so as to spell any words, and no key will open them but one adjusted to that word.

Tanning, by atmospheric pressure and the forcing-pump, is performed in a few weeks, and used to employ twelve times the period.

The best workmen use the simplest tools. The highest polish of cutlery is produced by a woman's hand.

A sheet of paper has been made 13,800 and 24,000 feet long, and 4 and 10 feet wide.

A good hand makes 5000 bricks per day.

A patent in the United Kingdom, owing to the multiplied fees of sinecurists, costs from 100*l.* to 125*l.*, and it secures for 14 years. In France and the Netherlands it is for three terms of five years, which costs from 12*l.* to 60*l.* in France, and 6*l.* to 30*l.* in the Netherlands. In the United States for 14 years, and costs but 6*l.* 15*s.* Spain grants 15 years to an inventor, 10 years to an improver, and 6 years to an introducer. The number in England, France, and Austria, is about 160 in each, per annum.

Patterns, in printing, are first engraved on steel, hardened, and then transferred to copper rollers. Five colours can be fixed at once.

Plated goods are made at Sheffield and Birmingham, by rolling with machinery a block of copper, on which is laid a plate of silver till it is the required thickness.

There is a manufacturing room, at Heap Bridge, near Bury, 85 yards long, 75 wide, and 12 high. In it are 2688 feet of shafting, 8 large carding-engines, 8 slubbing-frames, 40 mules, and 200 looms, all worked by one engine

Of machinery and mill work, about a quarter of a million, in value, is annually exported.

At Molsheim, near Strasburg, are large iron-works, where machinery, saws, files, and edge-tools, are made in perfection.

Carpets, &c. are now manufactured in France of vegetable fibres, called silk, 15 or 20 feet long, the tenacity of four of them equal to 40 pounds.

Lowell, near Boston, is the seat of very flourishing manufactories, wrought by the water-power of a canal which falls 30 feet in 2500 yards. It is 60 feet wide and 8 deep, and affords 1250 cubic feet of water per second, which acts on wheels of 30 feet.

The 22 telegraphs on the line from Paris to Lisle, transmit a signal in 2 minutes. The 27 to Calais, in 3 minutes. The 46 to Strasburgh in 6¼ minutes. The 50 to Lyons in 8 minutes. And the 80 to Brest in 12.

The state of New York has 6948 saw-mills, 2051 grist-mills, and 1060 carding.

Two American patents have been recorded, for using the rise and fall of the tide as a power for machinery, by its action on large floats connected with chain cables on the shore.

Since action is always equal to re-action, and either the actor or re-actor may be one, or may be many in different angular directions; so the single action or re-action will affect the opposite point only in maximum, and the scattered bodies inversely as the sines of their angles. A tendency will, however, be created in those bodies (if free to move) to unite in the opposite point; and this neglected principle may account for many phenomena hitherto ascribed to impossible powers of material attraction, &c. especially in a planetary system subject to the action of one centre.

Diagrams often mislead both analysts and the vulgar. They usually exhibit what takes place only *in long time*, as mere historical emblems, not present mathematical relations.

In Philosophy, opinions are generally absurd in the direct ratio of their antiquity.

In Philosophy, truth is in the inverse ratio of the dogmatism of schools and authorities.

In Philosophy, there is no inverse ratio to the evidence of experience and abstract demonstration.

In Philosophy, no direct ratio in support of opinion is derived from social rank or distinction.

In Philosophy, as the sale of books is in the direct ratio of their conformity to general and vulgar prejudices, so the opinions of books are commonly in the inverse ratio of truth, and this inverse ratio increases as the books are costly in their preparation.

In Philosophy, the advancement is in the direct ratio of doubt in regard to existing dogmas.

In Philosophy, when first principles assumed in the infancy of an inquiry lead to confusion and mystery, the first principles are the inverse ratio of truth.

In Philosophy, there is an inverse ratio in assumptions of societies, who substitute the acclamation and suppleness of numbers for the modesty of retired demonstration.

In Philosophy, there is an increasing inverse ratio, arising from formula derived from mathematical analysis, founded on false or equivocal data, in which, as in the ancient syllogism, the value and relevancy of terms often undergo change, and therefore prove what is false as plausibly as what is true.

In Philosophy, in fine, there is no test of truth, but in the unprejudiced, unsophisticated, and disinterested average intellect of man.

ANIMATED NATURE.

(General Circumstances.)

There are in species

Of mammalia	1200
Of birds	4000
Of amphibia	1500
Of fishes	7000
Of mollusca	4500
Of annelides	315
Of crustacea	259
Of ararchnida	138
Of insects	12500
Of enthelmenta	1100
Of radiaria	250
Of medusa	208
Of zoophyta	536
Of rotaria	291
Of infusoria	291

The total in the highest numbers of modern naturalists are about 70,000, though Linnæus did not make them above 20,000.

The genera of insects are 1,423, and of crustacea 209 per Latreille, which latter Linnæus made but 3.

Sachs makes 50,000 species of insects, besides 26,000 Arachnida, and 1,500 Crustacea.

Humboldt makes the known species of insects 44,000, of fishes 2,500, reptiles 700, birds 4000, and of mammiferous animals 500.

Adanson gave an arrangement of 40,000.

The known number of species of organic being are 140 600, exclusive of reptiles; but the probable numbers are estimated by Swainson at 577 600, the insects being taken at 550,000, and the reptiles at 1,500.

Climate greatly varies species. Greenland sustains 467 species of all kinds of animated nature; Wirtemberg 4,500 and Nice 4242, independently of infusoria, &c.

Our John Kay was the first systematic zoologist. He published in 1693.

The Systemæ Naturæ of Linnæus was first published in 1735.

Cuvier reduces all animal nature to 4 types—vertebrata, mollusca, articulata, and radiata. The *first* have a back-bone and skull, with appendages, viscera and muscles. The *second* are soft, and have muscles attached to the skin or bony plates. The *third* are crustacea, insects, and worms. The *fourth* are zoophytes, whose members radiate from a centre.

The bony skeleton distinguishes fishes; muscles, reptiles; nerves, birds; and the perfection of nerves, mammalia.

Animal organization consist of *ten classes*, depending on their bony structure,—their warm or cold blood,—their mode of rearing their young,—lungs or gills,—and bony or no bony parts.

1. Mammalia have a double heart and warm blood, with an internal bony skeleton and brain, and they suckle their young.

2. Birds have the same, but do not suckle their young.

3. Reptiles have lungs, and jointed or divided members, but a single heart and cold blood, with a brain and skeleton.

4. Serpents have lungs, and a single heart and cold blood, but no jointed members, with a brain and skeleton.

5. Fishes have gills and fins, and no lungs, with a single heart and cold blood, with a brain and bony or cartilaginous skeleton; and no jointed or articulated members.

All animals having vertebræ are called Vertebral.

The following have no internal skeleton, and no brain, as—

6. Crustacea, with articulated members, and a circulatory system, with gills or branchiæ.

7. Insects like the former, but with trachiæ and no circulating system.

8. Mollusca, with simple nerves.

9. Worms, with knotted nerves.

10. Zoophytes, with no nerves and no vessels, but without articulated members, and no skeleton or brain.

The last five are called Invertebral.

The Linnæan Arrangement embraces Minerals, Vegetables, and Animals, in Classes, Orders, Genera, Species, and Varieties, with names and characters.

In Animated Nature he has six classes, consisting of

Mammalia, in 7 orders, 47 genera, and 577 species;

Aves, 6 orders, 90 genera, 2641 species;

Amphibia, 2 orders, 19 genera, 366 species;

Pisces, 6 orders, 66 genera, 889 species;

Insecta, 7 orders, 131 genera, and 10,896 species;

And Vermes, 5 orders, 118 genera, and 4036 species.

In all 19,405 described species.

But two millions of species of terraqueous animals and plants are believed to exist. There are at least 160,000 species of plants and 400,000 of insects only. The species in the seas are believed to be still more numerous. The number of Polypes exceeds that of other insects, and the Infusoriæ are not numbered, nor are the Parasitic tribes. The species of the whole may even be five millions. If an old species became extinct, and a new one were evolved once a week, the whole would last 100,000 years.

We may imagine, that at the first the forms of organized beings were almost infinite in number, and that they have been constantly narrowed, either by their own unfitness, or their incompatibility with the claims of other species on the products of nature. Hence species constantly disappear. We now find neither mammoths, nor enormous lizards, gigantic elks, &c. &c. whose remains are in modern strata.

The hands and arts of man enable him to be the universal destroyer and monopolist, and he uses his power without sympathy or remorse. Asia, Africa, and Europe, he has peopled and *worn out;* and America and New Holland will be densely populated and worn out within 500 years. At the same time, by destroying, he diminishes his means, and breaks the circle.

In mammiferous quadrupeds the quantity of respiration is less than that of birds, but is greater than that of reptiles, on account of the structure of the respiratory organs; and exceeds that of fishes, on account of the different elements in which they live. Hence result the four kinds of movements, which the four classes of vertebrated animals are particularly destined to exert.

Mammiferous animals, in which the quantity of respiration is moderate, are generally formed to develope their strength in walking or running.

Birds, which have a larger quantity of respiration, have the activity and strength of muscles necessary for flying.

Reptiles, in which respiration is more feeble, are condemned to crawl; and many of them pass a part of their lives in torpor.

Fishes require to be supported in an element nearly as heavy as themselves, in order to exert their motions in swimming.

The distinctive characters of the four classes of loco-motive beings, founded on

the circulation and respiration, are thus given by Cuvier.

Mammiferous Animals have a double circulation, and the aerial respiration is simple, by the lungs only.

Birds exceed mammiferous quadrupeds in the quantity of their respiration, for they have not only a double circulation, and an aerial respiration, but they respire also through other cavities besides the lungs, the air penetrating the whole body, and the branches of the aorta or great artery of the body, as well as the pulmonary artery.

Fishes have a double circulation, but their respiratory organs (the gills) are only formed to respire by the intervention of water, and their blood receives only the portion of oxygen mixed in the water.

In Reptiles, the organs of circulation are simple, and only a portion of the blood brought back by the veins passes through the organs of respiration.

The term *Order* denotes a subordinate division, and bears the same relation to a class which this latter does to a kingdom; so that a *class* is made up of *orders*, in the same manner as a kingdom is made up of classes. The next subdivision to an order is a *Genus*; and this is itself composed of *Species*, which comprehends all those animals which may reasonably be supposed to be descended from one common stock.

It is usual, in works of Natural History, to place the scientific name of a species after the popular or local name. By the scientific name the species is recognized in every country, while the popular or local name is limited in its use. But as the same species are often called by several scientific names, each of which has been given to it by a different naturalist, it is also usual to place the name of the naturalist after the word which he has invented or adopted.

Mammalia, and birds, have two auricles and two ventricles. Warm red blood.

Amphibia and fishes have one auricle and one ventricle. Cold red blood.

Insects and worms have one ventricle and no auricle. Cold white blood.

Mammalia, birds, fishes, and amphibia, have two nervous systems, the cerebro-spinal and the ganglion.

Mollusca, crustacea, spiders, winged insects, annelides, &c. have a nervous system in the œsophagus, with ganglia, and a sympathetic nerve, with tracheæ for respiration.

Zoophytes have a nervous system, but no sexes, no centre of sensation, and no heart, or respirable organs.

Birds and reptiles have no urinary bladder, and the urine passes into the rectum or cloaca.

The yellow poison of serpents is secreted by two glands above the upper-jaw, and conveyed to a tooth which the animal can erect or depress at will.

The marsupium bag, or secondary uterus of some animals, is provided with nipples, and not merely a place of refuge.

The bones of young birds are not hollow; a short time the centres are marrow, and this soon disappears, and the round bones are filled with air.

Cetacea and amphibia are without a medullary canal.

Some animals which live on vegetables have no gall-bladder. It is the same with the pigeon, parrot, ostrich, and mollusca.

The hoofs of animals are similar to the nails of a man, and grow from the roots. Hair and feathers are analogous to human hair. Horns of animals are similar, in general, to nails and hoofs; in cows, sheep, &c. they are formed of concentric layers in fibres, like a collection of hairs agglutinated together. In deer, they are bones attached, but in the giraffe part of the skull.

The definite sizes or expansions of all genera and species result from the *balance*, at maturity, of the assimilations and eliminations. During growth, the assimilations are in excess; during decay, the eliminations. At maturity, they come to a balance. There seems to be a law or ratio of these powers for every genus, similar by analogy to the law which generates different curves by the varied ratio of ordinates and abscissæ. The life of every species may, on this analogy, be represented by the forms of curves; and abscissæ and ordinates may be deduced conversely from the times of growth, maturity, and decay.

All animal structures are similar, or analogous. Bones of phosphate of lime, or shells of carbonate of lime as bases, or frames for strength. Tissues and ligaments for union. Tendons and muscles for deflecting motion from the ground, or reaction from fluids. Tubes or pipes for circulations. Glands for secretions. Stomachs for trituration and absorption. Intestines to carry off excrementious matters. Nerves with brain or ganglea for directing motions. Senses to discriminate and protect nerves of perception. Lungs to fix oxygen, and excite and restore the arterial blood. The skin to cover the whole, and fix nitrogen for venous blood. The heart to propel the arterial blood. Other viscera for subordinate purposes. The whole forming a microcosm which grows and lives, and then dies to make room for renovated organizations.

All animal matter contains ammonia, nitrogen, and sulphuretted hydrogen, neither of which are in vegetables, and consequently not in the food of those who live on vegetables.

The fluids of animals contain alkalies, especially soda.

Silica and manganese are found in the hair. Iron with phosphoric acid constitute part of the blood.

There is iron enough in the blood of 42 men to make a plough-share weighing about 24 pounds.

The proximate principles of the body are albumen, fibrin, and gelatine, with mucous and oily matter, which by analysis are resolvable into oxygen, hydrogen, nitrogen, carbon, phosphorous, and sulphur.

Bones are composed of gelatinous fibres in net-work, and of earthy salts, as phos-

phate, carbonate, and sulphate of lime. The gelatine prevails in young animals, and, hence their bones are flexible.

In the fœtus the bones are gristly, and ossification commences at their centres.

The prime agent, in animal systems, is described to be *the cellular tissue*, or membranes, which extend through every part of the body, under various names and functions. It constitutes what is called tone and vigour in the system, and this depends on the facility of its contractions.

The cellular tissue is the most universal formation in the structure both of animals and vegetables. It protects and unites every organ, and composes many. In its cells, salts are secreted for bones, and gelatine for cartilages.

The fibrous tissue forms vegetable fasciculi, and by its ligatures and tendons unites the bones and muscles.

Organization proceeds by cellular tissue; motion by fibrin; sensation by medullary substance; and the fibrous confers resistance and strength.

As the cellular tissue consists of crossing threads, rather than cells, it has properly been called the filamentous tissue.

The lymph is acid, the bile alkaline.

The fluids which effect a purpose in the system are alkaline, and those which do not, are excremental and generally acid.

Horn is distinguished from bone by its bending, and softening by heat and water. It consists of albumen, some gelatine, and phosphate of lime.

The two hands of man direct his name Bimana. The four hands of most monkeys lead to their being called Quadramana. Those with no thumbs, or opposing finger, are called Feræ, or carnivorous. The *Pecora* have cloven feet, no incisors in the upper-jaw, and quadruple stomachs. The *Pachyderma* have thick skins, slightly covered, with only one apparent toe or hoof.

Many which have opposing thumbs on their hind-feet, have none on the fore-feet.

The guinea-pig has 10 teats, the rat 12, and the hare 10. In a laying hen, the ovary contains a great number of yellow round bodies, each in its own membrane or calyx, which when exuded, is received into an extension of the membrane, forming a bunch, of which the outer are the largest. These are the yolks of future eggs, to be provided with whites and shells.

The procreative powers of animals are so various, that Linnæus had a design to extend his sexual system to them. Leeches, worms, snails, slugs, are hermaphrodite.

Crustacea have teeth within the stomach.

In serpents and fish both jaws are moveable.

In animals that have no circulating system, the air is respired by air-tubes running below the skin, called tracheæ, as in insects and mollusca; or, it passes through the integuments to every part of the body, as in worms and zoophytes.

The lungs of birds are small, and of a flattened form, and much dispersed; but they respire through the bones and in cavities of the muscles.

In the larva of insects there is an air-tube on each side, with branches and apertures.

The neighing of a horse is effected by a membrane which is attached to a cartilage, and runs along the margins of the glottis. The braying of an ass is produced by a similar membrane, and 2 large sacs, which open into the larynx. It is the same with the mule. In apes, the bone connected is concave, and hence their noises.

All animals ruminate which have horns and cloven feet.

The power of reproduction in insects is one of the most wonderful parts of their economy. On beheading a slug, a new head, with all its complex appurtenances, will grow again; so with the feet of the salamander and the claws of lobsters. The end of a worm split produces two perfect heads, and if cut into three pieces, the middle reproduces a perfect head and tail. Reproduction is also evidenced in the growth of trees from slips and cuttings, of polypæ and worms from small fragments, and of the renewal of the claws of crabs and lobsters, with all their nerves and parts in perfection. So also in the skin, hair, and nails of man.

The *rete mucosum*, the coloured layer which lies between the cuticle and the skin, is one-sixteenth of an inch thick in whales, and is of the consistence of the grease rubbed between the nave and the axle of wheels. The rete mucosum gives colour to all animals, and Cuvier considers shelly coverings as analogous to it.

Trevinanus determines that the cellular membrane, in vertebrated animals, is composed of tubes. The relations of their diameter in man 0·002 millimetres, and rabbits 0·0011; while the globules of blood are larger, or 0·004 and 0·0049. The celebral mass also consists of tubes containing pulpy matter, and larger in the medullary than the cortical, and still larger in the nerves, and always in bundles.

Hair, from the silk to the wool, bristles, and spines, belong to mammalia; feathers to birds; and scales to fishes. They connect the outer elements with the cellular membrane.

In many animals, torpid in the winter, the fat in the cellular membrane is absorbed as nourishment. In some, as whales, hogs, seals, &c. it is nearly fluid. In some, the integuments have muscles; as for laughing in man, for coiling in the hedgehog, for moving feathers in peacocks, turkeys, &c.

The ossification of soft parts of bodies arises from the deposit of phosphate and carbonate of lime on the part.

All hair is hollow and cylindrical. Young birds are covered with it, and feathers are a variety produced from a bulbous root in the skin. Hairs are a sort of vegetation on animals. Their trunks are round, triangular, or square. It may be bleached on grass, like flax, and dyed of any colour. It is made to curl by boiling and baking. 1152 grains yield 90 of carbonate of ammonia, 179 water, 288 gas, and 324 coal. It con-

tains silex, sulphur, oil, iron, manganese, and lime. It measures in man the forty-eighth of an inch.

Haller and Cuvier discovered the relative proportions of the body to the brain as under:—

A child of 6 years	22	to 1
An adult	35	to 1
Ourang-Outang	35	to 1
American monkey	24	to 1
Baboon	104	to 1
Elephant	500	to 1
Ox	750	to 1
Horse	700	to 1
Ass	254	to 1
Sparrow	25	to 1
Canary	14	to 1
Cock	25	to 1
Fox	205	to 1
Tortoise	2240	to 1

The sleep of winter and that of night are different in those animals which are torpid for months. The bat, the hedgehog, the tawrie, the marmot, the hamster, the tortoise, the toad, snakes, mollusca, spiders, bees, flies, bears, badgers, &c. retire to their closed holes, and, in various degrees, undergo a temporary death for four, five, six, and seven months of the year. They usually roll themselves up, but bats suspend themselves in caves. Those who lay up provisions use them before they become torpid, and on reviving before they venture abroad.

When a cow of the black-cattle breed has two calves, one a bull and the other not, this other never breeds, and is of different character in size and habits, and known among farmers as a free martin, having the bellow of an ox, and no sexual propensities. Earth-worms, &c. are of both sexes; and caterpillars and larva generally are of no sex till they change. All plants are hermaphrodite, except monœcia and diœcia. Mules and other mixtures do not propagate. Some cause of the same kind affects branches of the human family as stops to population; and hence the continual extinction of families; the males particularly being without offspring, as impotent or withered branches. Swammerdam traces this defect to luxury, and to breeding in and in, and asserts that it arises oftener in royal and noble races than in families which mingle or cross breeds.

The produce of different species, or hybrids, as the mule from ass and horse, do not propagate; and this has been made a test of species, but is not always correct, for mules often propagate, and especially in warm climates; so also the progeny of the dog and wolf, fox and jackall, of the bison and cow, of sheep and goats, of a ram and deer, of sea-lions and sea-bears, &c. in all of which the hybrids propagate with the parent races, but not among one another. Pritchard infers from this, that the human races are all of one species.

The ancients had refined notions of the universal sexuality of *continuous* organized beings, now so accurately systematized. They called it *Psyche*, love, &c. whose product was the universal mundane egg, and on this idea their poets played.

Migratory animals are lemmings, rats, bisons, wild horses. Among fishes, the salmon, cod, herring, pilchard, and anchovy. Among insects, locusts, ants, &c. Among birds, storks and swallows return to the same spot, however distant their migrations.

In cold climates, animals in winter acquire either an excess of covering, or they become torpid and retire into holes.

The peculiar secretions of animals, used by man, are as under:—

Castor, near the end of the rectum in the beaver.

Civet, in the same part of the civet-cat.

Musk, near the navel of the male musk

Oil, by birds, to lubricate their feathers, taken from the rump.

Poison, by serpents.

Silk, by the larvæ of the silk-worm, and the webs of spiders.

The *acrid matter* that passes through the stings of wasps and bees.

The *inky fluid* of the cuttle-fish, in a bag near the anus.

Silky matter, produced by the sea-mussel, &c.

Ambergris, an internal production of diseased spermaceti whales.

Spermaceti from the head of the cachelot, and *ambergris* the excrement of its intestines.

The *Bezoar stone* in the stomach of goats, antelopes, and sometimes camels. Its nucleus appears to be some indigestible hard seed or stone, and its specific gravity is from 1¼ to 2¼.

The genus *mephitus* has glands near the anus, which secrete a fœtid acrid liquor, which they squirt on their enemies with unerring destruction to clothes and skin, and so offensive as to be distinguished for a mile.

The tails of monkeys are prehensile. The proboscis of the elephant, owing to its opposing termination, is the most perfect of all prehensile organizations, and a fifth limb.

All horned animals have cloven hoofs, and, in general, have no front teeth above.

The hind hoof embraces all the toes, and the fore hoof consists of flattened toes with greater sensibility.

The grinders, or cheek-teeth, are in herbivorous, or hoofed animals, flat at the crowns, in a jaw which moves horizontally. But, in carnivora, or toed animals, they are like scissors, or a saw, with only an opposing force. Besides these, all have canine teeth and incisive teeth.

Oviparous quadrupeds live long without food. The tortoise and crocodile a whole year. They are gentle, grateful, and long-lived. Their young have no parental care, but they go hundreds of miles to secure places for their eggs.

Animals with spines, as porcupines, hedge-hogs, &c. have a great developement of muscles to the skin.

A chamelion has a horror of black; a bull, a buffalo, and a viper, of scarlet. Bright yellow flowers decoy perch.

Elephants and hippopotami are fond of music, and the hare is fond of a drum.

Compound stomachs exist in ruminant animals, the sloth, and cetacea. The sloth and cavy have two stomachs. Ruminants have four: the paunch, the king's hood, the maniples, and the red. The maniples, or folds, are 40 in the sheep, and 100 in the ox. The camel is similar, but the king's hood consists of cells for retaining water. Birds have three: the first is the crop with stones in it to grind the food, instead of teeth; the second, the glandular crop; the third, the gizzard.

In the ape and bear families, the length of the intestinal canal is from 5 to 8 times that of the body. In the lion, ocelot, and weazel, it is 3 times; hyena, 8 times; agouti, 16 times; sloth, 3½ times; ram, 28 times; ass, 9 times; horse, 10 times; in the Asiatic elephant, 10 times; in the African, 7; and in man, 7 times his heighth.

The cow eats 276 plants, and rejects 218; the goat, 449 and 126; the sheep, 387 and 341; the horse, 262 and 212; the hog, 72 and 171.

Wild ducks are estimated to fly 90 miles an hour, swallows fly rather faster, and the swift flies above 200 miles in an hour.

The roe of the cod-fish, per Harmer, contains 3½ millions of eggs, of a large flounder 1½ million, of a large mackarel 450,000, and of tench 280,000.

Hogs and dogs were the only animals in the newly-discovered South Sea Islands. The West India Islands contained only a small animal, the agouti. The continent of America contained many large animals, but unlike those of the old Continent.

Asses, hogs, black cattle, sheep, dogs, and cats, introduced into America by Columbus, have increased to numbers beyond estimate. Vast droves of wild asses and buffaloes maintain their pasture, and wild dogs hunt in packs.

The largest quadrupeds are now on the old continent, but America once contained the largest, still discovered in a fossil state, and it still contains huge monsters, called sloths.

All the tribes of quadrupeds differ in species, in the old and new continents, and also in Asia and Africa.

All the marine animals of the Southern ocean, even of similar species, may be distinguished from those of the Northern. Insects vary, of course, with trees and plants, and even birds, so free to move, have their locations, and a foreigner would be hunted to death. Sparrows who occupy one side of a building do not mix with those on the other side. The condor belongs only to the Andes chain, the emu to Australia, and the great eagle to the Andes.

In Australasia there is an organized world of its own, and nature displays new types and new forms. Its animals, as the kangaroo, have a double gestation, the females have a pouch formed by the integuments of the abdomen, with marsupial bones to sustain it. In it are paps for suckling, and the half-formed embryos are there completed till able to provide for themselves. How they pass from the uterus to the pouch has not been determined. The birds too are different, since there being no forest fruits, their apparatus for feeding is peculiar, and its swans and cockatoos are black.

All the quadrupeds of the continent were once natives of Britain, because, in a remote geological epoch, there were neither German ocean nor British channel, and the bear, wolf, wild boar, beaver, &c. filled our woods, till exterminated by the occupation of man. Bears were hunted in Wales and Scotland, within the historic period. So late as Edward the First, there were royal appointments to kill wolves. The last was killed in Scotland, in 1680, and they infested Ireland after 1710. Wild boars existed down to the reign of Charles I. The wild ox, or white long-legged urus, was the animal killed by Guy Earl of Warwick, and it once ranged the British woods. Specimens are preserved at Chillingham castle. Bulls weigh 560 lbs. and have manes, the cows 480 lbs., and both are untameable. Beavers lived in Wales till its union with England.

In digging ponds in the interior of countries, it is found that in some countries they soon abound in various fish. The soil having been under the sea in remote ages the spawn may exist in the sand, the fish being vivified by the access of water just as the germs of animalculæ are revived by water in the vegetable substances infused.

The sphinx, satyr, mermaid, centaur, unicorn, hypogreff, hydra, dragon, griffin, cockatrice, &c. are now believed to have been poetical creations of the ancients, though so gravely described by many authors, and introduced, as fact, on the celestial globe, in a series of real animals.

Marcel des Serres infers, from the figures of animals on the great Mosaic of Palestrina, 20 feet by 15, that several species have disappeared within 1900 years; and he adduces ancient drawings in support.

Animals are universally organizations, which are qualified to fix or appropriate the motions of the atoms of the gases that constitute the atmospheric air. The air, in being converted from oxygen and nitrogen into carbonic acid gas and nitrogen, by the galvanic or antagonist chemical action of the lungs, loses a portion of its atomic motion; and this being imparted as heat to the blood, is by it transferred to the system, conferring the energies of life. It is a process exactly similar to combustion, but no flame appears, owing to the excess of fluids in the system.

Animals live within this world of atoms in such intense motion, and the functions of life consist in respiring them, fixing certain of them, and displaying the results in their own bodies by activity, sensation, and all the various pheuomena of life.

All animals display varied and strong intelligence, but we notice most those acts which resemble our own. Thus, the species of the *motacilla*, called the tailor-bird,

nite numbers which we discover. Fitness is the universal law of duration and continuity.

The habitudes of all animals accord with their forms and resources, and these are called their *instincts;* but these habitudes or instincts are pursued by various details of choice and preference, and so mingled with incidents and circumstances, as to imply rational comparison, and the use of their varied experience. Their senses, in fact, would be worse than useless, if they did not qualify them to discriminate and exert the free-will of choice. Every animal looking at the habitudes of others may, however, ascribe them to instincts, or to such a necessity as governs a falling body; so that if the brain or its substitutes did not act in all, there would be as many modes of natural action as habitudes, which is absurd.

The bloody set-battles among animals of the same species, and their deference in the same pasture, prove the existence among them of moral sentiments.

The various cluck of the hen displays anger, grief, fear, and joy. The language of the cock is distinctly varied for every purpose; most animals vary their tones by various passions, though the vanity of man does not regard it.

Leibnitz states that he heard a peasant's dog utter 30 common words.

The Ouarine monkeys assemble and sit round, while One speaks. They then signify assent or dissent, and the speaker waves his hand and resumes his discourse.

All animals have been tamed by suitable treatment,—even the hyæna, the rhinoceros, the lion, the tiger, the alligator, and the crocodile. The tiger, wolf, &c. have remembered a former master for years, and received them with extreme affection. The most inimical animals have been brought to live in amity and familiarity. Kindness subdues the most ferocious in all cases, and few forgive injuries, even for years.

Natural history in *living* objects, well treated, as at the two Zoological Gardens near London, or the Jardins des Plantes, is a very amusing study. Variety of forms is a barren object, but habits and passions of living animals are inexhaustible subjects.

The Zoological Gardens, Regent's Park, contained, in 1836, 294 mammalia, 693 birds, and 27 reptiles.

The cruelties practised by entomologists, and collectors of specimens in natural history, are, as matter of mere curiosity, inexcusable, and impeachments of the sympathy and benevolence of the enthusiasts who practice them. Microscopic curiosity often leads also to very great cruelties. All the world have agreed to condemn the monstrous barbarities of theoretical and experimental physiologists. Relatively, butchers, fishmongers, poulterers, and cooks, are persons of refined sentiments.

Every region has its own earths, minerals, vegetables, trees, insects, and animals; and nothing can be more distinct and characteristic than their distribution in species, and often in genera. The types are alike, because all elementary operations are in definite proportions, and the atmosphere, the elements, the motions of the Earth, and the action of Light and Heat are common.

The whole globe is like two mountains placed on the equatorial plane. The vegetation and zoology vary from the equator to the poles just as they would on mountains, and the poles or summits like them, are involved in perpetual congelation. The regions of Etna or Teneriffe, in species, almost exactly accord with latitudinal breadths, and the longitudinal accord with the soil and local circumstances.

The hygrometer shews less moisture, according to elevation, and in this respect the two hemispheres represent a mountain, for the hygrometer exhibits the greatest moisture at the equator.

De Candolle makes 20 botanical regions, and Schouw 22, in which half the species, and a fourth of the genera are peculiar.

St. Pierre believed that every square league contained, at least, one peculiar vegetable and insect.

Linnæus sought to reconcile the creation of all genera and species in one spot, by the hypothesis that Paradise was a high mountain with every variety of climate, like Etna or Teneriffe. And Bishop Warburton, for a similar reason, conjectured that Noah assembled his pairs of species from some mountain near the place where he constructed the ark.

Several authors have treated of regions of distinct Floras; viz. Faunasas Treviranus, De Candolle, Humboldt, Brown, Schouw, Von Martins, and Mirbel.

Species are so local, that they are different on the east and west sides of the same country.

Of the whole there are, at least, 580,000 species of animated organizations, in which the principle and economy are similar, and the forms diversified, so as to constitute distinct species, with habits adapted to every habit and mode of life and subsistence. Of animalculæ and infusoria, there can be no estimate of species, but they indicate matter and liquids as swarming with life, and combine with visible beings to fix and consolidate the elements as food for vegetables, while these in return supply sustenance for a whole globe swarming with life, derived from its own motions and the solar heat. If the juxtaposition and the wants create much misery, it seems to be preferred that many should perish rather than any spot should be without enjoyment.

The periods of gestation are the same in the horse and ass, or 11 months each. In the camel 12 months. In the elephant 2 years, and in the lion but 5 months: in the dog and cat 2 months: in the human female and cow 9 months, and in sheep 5 months. The hen sits 21 days, the goose 30, and the duck 30. In the she-wolf, the period of utero gestation is from 90 to 95 days, and in the dog but 62 or 63 days.

A new classification of the Animal King-

dom has been published by Dr. Grant, beginning with the lowest:—

ANIMALIA.

I. Sub-regnum, Cyclo-neura vel Radiata.
1. Polygastrica—*microscopic animalculæ.*
2. Porifera—*sponge.*
3. Polypifera—*coral.*
4. Acalephæ—*sea-nettle.*
5. Echinoderma—*star fish.*

II. Sub-regnum, Diplo-neura vel Articulata.
6. Entozoa—*tape-worm.*
7. Rotifera—*wheel-insect.*
8. Cirrhopoda—*barnacle.*
9. Annelida—*leech.*
10. Myriapoda—*centipede.*
11. Insecta—*bee; butterfly.*
12. Arachnida—*spider.*
13. Crustacea—*lobster.*

III. Sub-regnum Cyclo-gangliata vel Mollusca.
14. Tunicata—*cynthia dione.*
15. Conchifera—*oyster.*
16. Gasteropoda—*snail.*
17. Pteropoda—*clio borealis.*
18. Cephalopoda—*cuttle-fish.*

IV. Sub-regnum Spini-cerebrata vel Vertebrata.
19. Pisces—*salmon, shark.*
20. Amphibia—*frog.*
21. Reptilia—*crocodile, serpent.*
22. Aves—*eagle, humming-bird.*
23. Mammalia—*whale, monkey, man.*

OF MAN.

The Genus *Homo* is divisable, according to colour, into four species: the white, the copper-coloured, the tawny, and the black.

The *whites* are carnation or reddish, dead white, and dark.

The *tawny* are yellow and dark brown, as the Arabs, Jews, Hindoos, Persians, &c. The *dark brown* are the Calmuc Tartars, Chinese, and Gypsies.

The *copper-coloured* are the native Americans.

The *blacks* are Negroes, with woolly hair; and Malays, &c. with straight hair.

Other *black-brown* are the Malays and South Sea Islanders.

The species of men are also determined by the hair, as, woolly, or long, black like the Hindoos, or flaxen and white, as Goths or Swedes.

By physiognomy, as the European, the native American, the Negro, the Hindoo, the Chinese, the Tartar, and the Hebrew.

By skull, as the *Caucasian*, round, cheek-bones low, and face oval; the *Mongolian*, head square, cheek-bones projecting outwards, nose flat, angle of the eye depressed to the nose, or cat-like; the *Negro*, narrow and compressed, forehead very convex, cheek-bones projecting forwards, nose flat, and nostrils wide. The American, like the Mongolian, but the forehead low, and eyes sunk; the Malay, summit narrowed, upper-jaw projecting, features more prominent than the Negro.

The Mongolian family includes the Tartars, Siberians, and Chinese, Esquimaux, and Laplanders. The two last, however, appear to be distinct.

The Hottentot family seem also to be distinct from the Ethiopic race.

The Malayans brown, and skins soft, black hair, head narrow, and nose broad at top, large mouth.

Ethiopians or Negroes, black skins, woolly black hair, head compressed laterally, large black eyes, thick upper lips, and chin falling back.

Native Americans, red copper complexion, hair straight, black eyes, deep, broad face, and flat nose. These are considered as distinct families of the human race, though intermixed in every shade.

The original inhabitants of the European nations were the Celts, Goths, and Sclavonians. The purest Celts are to be found in Wales, Goths in Denmark and Sweden, and Sclavonians in Poland. The former are distinguished by black eyes, black hair, and a sad complexion. The Goths by light eyes, light hair, and fair complexions. The Sclavonians by a browner complexion, dark eyes, hair, and red beards.

Buffon made seven varieties of the human race, in which he included stature.

Blumenbach defines man—*order*, bimanum; *genus*, homo; *species*, single with several varieties; *teeth* close and of equal length, with inferior incisors perpendicular, prominent chin; characters, erect stature, reasoning, endowed with speech, defenceless. B.'s species are the Caucasian, or white; the Negro, or black, with woolly hair; the Malay black with long hair; the Mongolian, or tawny, and the American, or copper colour. Of each of these there are Varieties in different nations, created by climate, diet, and habits. He found three varieties among Egyptian mummies.

Climate does not produce species, for in the same burning latitude we have the indigenous coal-black negro with his woolly hair, and at Para in South America, the reddish-brown Indian, with long hair, and as decidedly indigenous, as the negro of the Gold Coast. And in lat. 36 S. in Africa, we have the dwarfish and squalid Hottentots and Bosjesmen, and in the same lat. in South America, the noble and full-grown race of the Patagonians.

The form and stature of men differ as much as distinct species of animals. The arms, legs, and feet vary, and the stature from seven feet in the Patagonians to 4 to 5½ feet in the Esquimaux, Laplanders, Samoides, and Bosjemen, some not four feet. The species intermingle and produce varieties; but the species, to the number of seven or eight, are as distinct as the dog from the wolf, the horse from the ass, or the deer from the antelope. In this conclusion, phrenologists agree with anatomists.

St. Vincent, Grant, &c. give 15 species to the biped genus, founded on varieties of colour, hair, size, physiognomy, and language. The Japetic, the Arabic, the Hin

doo, the Scythian, the Hyperborean, the Neptunian, the Australian, the Columbian, the American, the Patagonian, the Oribotic, or Negro, the Ethiopean, the Caffre, the Melavian, and the Hottentot. Each of these are indigenous in certain tracts; and in certain cases have no common resemblance, but the generic resemblance of walking upright on two legs.

Differences of colour, woolly and flowing hair, the broad faces, and small inclined eyes of the Kalmucs, the diminutive size of the Laplanders and Esquimaux, the pot-bellies of the Samoides, the humps and bumps of the Bosjesmen, the hairy and monkey-like faces of the Mallicolize, and the differences of temperament in all, seem to be conclusive that the causes which concurred to produce one race of men, concurred also to produce others in other regions.

Man is found from the 75th degree of north latitude to Terra del Fuego, south.

Boerhaave describes eight temperaments, the warm, cold, dry, moist, bilious, sanguineous, phlegmatic, and melancholic. The ancients divided men into the airy, the fiery, the phlegmatic, and the earthy; or, the sanguineous, the choleric, the moist, and the melancholic.

Seven constitutions are connected with disease: the sanguineous, or inflammatory; the phlegmatic, or relaxed; the erysipetalous, or nervous; the hypochondriacal, or spasmodic; the scrofulous; the rheumatic; and the arthritic, or gouty.

The grain on which man chiefly subsists, is rice, wheat, maize, barley, oats, and rye.

The atoms composing a man are believed to be changed every forty days, and the bones in a few months.

Modern physiologists divide the vital powers into muscular contractility, nervous agency, sensorial power, and organic affinities.

The common definition of man is false; he is not a reasoning animal. The best you can predicate of him is, that he is an animal *capable* of reasoning.—*Warburton.*

The more remote men are from artificial life, the more perfect are their senses and perceptions.

The human race have been used to be reckoned at 1000 millions, but modern enumerations do not exceed 700 millions. This has, probably, been the number during the historic period. Increases and decreases are local and temporary.

Varieties arise among the people of a nation, but it is highly improbable that these varieties were parents of separate nations in distant parts of the Globe. If parents in Persia had black children, it is not likely they would emigrate to Africa; or, if others had the Calmuc physiognomy, these would not emigrate to Tartary.

Inferences drawn by Pritchard, from universality of superstition, that man is but one species, are irrelevant. Superstitions every where only affect the listless, the feeble thinkers, and the grossly ignorant. Even conformity to them, in the prudent minority, renders their presumed universality only apparent. Superstition is an error or aberration of reasoning often artfully sustained.

Pritchard and others think, that extinct races of men have existed in most countries anterior to those whom we now call Aboriginals, and the opinion is sustained by general tradition and ancient works.

Women, so praised for kindness, fidelity, and hospitality, by travellers in all countries, are the originals of the oriental fancies about angels. Painters adopt this idea by always depicting angels as women. Male angels were either demons or analogical imaginations: they were the secondary powers of superstition, and they correspond with the scholastic fancies about Attraction, Repulsion, Fermentation, Caloric, and the like.

As the contemporary human race are the maturity of the several germs; and, as the effect of elementary re-actions and assimilations during growth are known, and very nearly the same every where, so varieties seem to result from original varieties in the several germs; for every growing and living being is, in fact, to be regarded as the expansion of its indefinitely small germ.

Man, born helpless, availed himself of his instincts and imitations of other animals, to seek asylums in caves. Born with a naked skin, he found convenience in clothing himself in the skins of animals. By a transition not yet complete, as to large portions of his genus, he raised his caves above-ground, and became an architect; and by combining fibrous materials, he became a manufacturer. This taste led him to adopt different styles of building, and his materials different fabrics. But, nevertheless, the varied progression proves, that certain species had more genius and aptitude than others; and this, combined with natural differences, seem to prove, beyond reasonable doubt, that species must originally have been as different, or nearly so, as the generic results in civilized and in still barbarous tribes.

Every individual has two parents; these have had four, the four have had eight, and so on, in a *geometrical series.* Hence, it is not difficult to determine the co-mixture of families, in past and in future ages, taking every generation as forty years, or 5 generations in 2 centuries, or 25 in 1000 years. 200 years previously, or 5 generations ago, the ancestors of every living individual were 2^5 or 32 persons.

400 years ago 2^{10}, or 1024;
600 years ago 2^{15}, or 32 768;
800 years ago 2^{20}, or 1,050,000 nearly;
1000 years ago 2^{25}, or 33,548,000.

So that this series, in duplicate ratio, connects every living person in Britain with 1,050,000 in the age of Edward the Confessor, and with the whole population in the age of Alfred. And, as it is in looking backward, so it is as to futurity. In 1000 years hence, 33,548,000 will be the posterity of every living parent of every child who has children, after an interval of 1000 years.

The co-mixture may not be complete, but such is the tendency, and, in degree, the effect.—*Walk to Kew.*

In this way the average powers of humanity and of animals are kept up, for, without mixture, families would deteriorate in faculties and become extinct. In one nation the people are all kindred in remote degrees, have had common ancestry, and will have common posterity.

Whatever were the original varieties of the human race, long time has so mingled them, that most nations are, more or less, a mixture of all. The ancient Conquerors, the Romans, the Crusaders, &c., and commerce and colonies have mingled all nations.

There seems reason to believe, that lines or branches of families wither, or cease to have the power of propagating. Records do not exist in regard to obscure families; but the extinct peerage, a class so favourable to propagation, proves the fact. Since Edward III., above seven hundred families have thus ceased to exist; and, in the reign of George III., no less than 48 titles became extinct, from the power of propagation ceasing in the male branches.

Hybrids, in some races, do not propagate, but in many others they do. The Forty Hybrid plants afford no rule. Hybrid birds are common, and propagate. Mules are not always barren, and many Hybrid animals propagate. Pritchard infers, that the propagation of blacks with whites, &c. is a proof that they are the same species, especially as the Hybrid progeny propagate.

Intellect seems to be averaged among men, and to be displayed in nations in the degree in which its exertions are patronized and distinguished. The Ethiopians, Egyptians, Hindoos, Phœnicians, Greeks, Romans, Saracens, &c. &c. have played their part with little difference beyond what arose from the varied efficiency of encouragement. In general, power is jealous of genius, and even in Greece, where it was freest, opposing interests were always strong.

In many countries, the formal institution of castes neutralizes much talent; and, in all, the virtual generation of castes, by pride and property, subdues 9-tenths of the genius. How much genius Pericles, Ptolemy, Lorenzo de Medici, and the Duchess of Saxe Weimar developed.

The productive industry of man in society resolves itself into pasturage, tillage, horticulture, mining, and manufactures.

Blumenbach possessed a library of works written by Negroes; from which it appears, that there is not a single department of taste or science, in which some negro has not been distinguished.

The enlarged brain and improvable intellect of man render the characters of his maturity as variable as his education, habits, and associations, which are varied in all nations, by climate, by means of subsistence, by hereditary prejudices, and predilections, and by religious and social castes. Savages do not enjoy civilized life more than civilized men endure savage life. Nova Zemblians prefer train-oil as the highest luxury, and Orientals their clangour of discords to European melodies and harmonies. All the conclusions of man are, therefore, relative, and the absolute can be discriminated only by the highest abstractions of science.

The facial angle is supposed to measure the brain in the cerebrum, but it fails. Birds have the smallest, and men the largest angles. The lowest ape has 42°, the Ourang only 30°, and the Troglodyte but 35°; one of the Simiæ, 50°, the Negroes and Kalmucs 70°; Europeans have above 80°, and Grecian Statues above 100°, as the beau ideal.

Termites, bees, and other insects, have no cerebral lobes; and yet they reason closely on all practices of their habitudes.

Breadth is a character of skulls.—Kalmucs have the greatest, Negroes the least, and Europeans are a mean. Blumenbach refers more to this test than to the facial angle, and he decides that there are 3 species, the Caucasian, the Mongolian, and the Negro. Pritchard adopts the base of the skull, and also finds 3 varieties.

The Negro skull and skeleton are heaviest and hardest. A Greek skull averages 27½ oz. Negroes vary from 28 to 17. Chinese 23½ oz.

The Negro skull is narrow, with a very protruded upper-jaw. Soemmering likens them to those of many apes, but there are differences.

All the Islanders and Tribes in the Southern Ocean are considered by Blumenbach as one distinct variety, or species of the human race.

Bory de St. Vincent considers the Bosjesmen of South Africa as the most degraded of the species, which has the usual characteristics of man. They do not, like many animals and insects, build any habitations, but live in holes and caves, and feed on the roots, fruits, insects, and reptiles of the woods. The Hottentots are the next remove above the Bosjesmen, and both are steps between Simiæ and white races, if New Hollanders and Esquimaux interpose not.

In the Northern borders of Ava, a people called Kookees build in trees, and live like monkeys, while in person they are the lowest specimens of humanity. They are cannibals, and speak a language of their own. They infest the mountains of Chittagong.

In Cretins, or idiots, a goitre disfigures the anterior part of the neck. In the Pyrenees, Switzerland, Styria, and the mountainous chain of the Crapacs, they are most abundant; in Thibet, the Ural, the Andes, and Sumatra, they are also met with.

In Albinos, the skin is white, the eyes weak, the iris red, the hair of a pale flaxen colour. Albinos, observed by voyagers in Java, form a wandering, proscribed tribe.

Accouchement is a very slight affair with North American Indian women. They go abroad the second day on their usual severe employment.—*Dunton.*

The Gypsies preserve their family colour

in every part of Europe; and the Jews preserve the same complexion, though dispersed for 2000 years all over the world.

Cases are said to have occurred, in America, of Negroes becoming white, and after-generations becoming whiter.

The Abyssinians, whose history goes back 3,500 years, have dark-olive complexions and long straight hair, though curly-headed blacks occupy all the tracts in their vicinity.

The Kalmucs, or Tartars, have oblique eyes, like cats. The nose is flattened near the forehead. The cheek-bones are prominent, with head and face round. The ball of the eye is brown, the lips fleshy, the chin short, and the ears very large and loose. They are naturally fair, but, from exposure, tawny. The hair is uniformly black. They occupy the north-east, east, and centre of Asia, including China, &c.

The posteriors of Hottentot women are covered with a huge mass of fat.

The Aboriginals of all America have a striking similarity. From Terra del Fuego to the St. Laurence they are of a swarthy copper colour, with straight hair, small ears, prominent cheek-bones, thick lips, long eye, gloomy aspect, and squat form.

There are families with six fingers and toes, in successive generations. A female with 6, had 10 children with 6, and the 11th had 6 on one hand, and 5 on the other; 9 generations of one family had a thumb and the fingers united without nails. The Imperial Family of Austria has had a thickness of the upper lip for 12 generations.

Weight and Stature of Men.

The Mean Weight and Stature of the Human Body at Birth, and at every subsequent Age, is as under:—

MALES.			FEMALES.		
Ages.	Feet.	lbs.	Ages.	Feet.	lbs.
0	1·64	7·06	0	1·61	6·42
2	2·60	25·01	2	2·56	23·53
4	3·04	31·38	4	3·00	28·67
6	3·44	38·80	6	3·38	35·29
9	4·00	49·95	9	3·92	47·10
11	4·36	59·77	11	4·26	56·57
13	4·72	75·82	13	4·60	72·65
15	5·07	96·4[illegible]	15	4·92	89·04
17	5·36	116·56	17	5·10	104·34
18	5·44	127·59	18	5·13	112·55
20	5·49	132·46	20	5·16	115·30
30	5·52	140·38	30	5·18	119·8[illegible]
40	5·52	140·42	40	5·18	121·81
50	5·49	13[illegible]·96	50	5·04	1[illegible]3·86
60	5·38	136·07	60	4·97	119·76
70	5·32	131·27	70	4·97	113·60
80	5·29	127·54	80	4·94	108·89
90	5·29	127·54	90	4·94	108·81
Mean....103·66			Mean....93·73		

The weight of the male infant, at birth, is 7 lbs. avoirdupois; that of the female is not quite 6½ lbs. The maximum weight (140½ lbs.) of the male is attained at the age of 40; that of the female (nearly 124 lbs.) is not attained till 50: from which ages they decline afterwards; the male to 127½ lbs., the female to 109 lbs.,—nearly a stone. The full-grown adult is twenty times as heavy as a new-born infant. In the first year, the child triples his weight; afterwards the growth proceeds in geometrical progression, so that if fifty infants in their first year weigh 1000 lbs., they will in the second weigh 1210 lbs.; in the third 1331 lbs.; in the fourth 1464 lbs.; the term remaining very constant up to the ages of 11—12 in females; and 12—13 in males; where it must be nearly doubled; afterwards it may be continued, and will be found very nearly correct up to the age of 18 or 19, when the growth proceeds very slowly.

At an equality of age the male is generally heavier than the female. Towards the age of 12 years only, an individual of each sex has the same weight.

The male attains the maximum weight about the age of 40, and he begins to lose it very sensibly towards 60.

At 80 he loses about 13·2328 pounds; and the stature is diminished 2·756 inches. Females attain the maximum weight about 50.

The mean weight of a mature man is 104 lbs., and of an average woman 94 lbs. In old age they lose about 12 or 14 lbs. Men weigh most at 40, women at 50, and begin to lose weight at 60. The mean weight of both sexes in old age is that which they had at 19.

When the male and female have assumed their complete developement, they weigh almost exactly 20 times as much as at birth, while the stature is about 3¼ times greater.

Children lose weight during the first three days after birth; at the age of a week they sensibly increase; after one year they triple their weight; then they require 6 years to double their weight, and 13 to quadruple it.

In a child the head is equal to a fifth part, and in a full-grown man to an eighth of the heighth of the individual.

The skeleton of a man weighs from 12 to 16 pounds, and the blood 27 or 28 pounds.

The human skeleton weighs from 9 lbs. 6 oz. to 12 lbs. 8 oz. The adult body from 130 to 140 lbs.

A calcined human body leaves a residuum of only 8 ounces. All besides is restored to the gaseous elements.

Mere drying reduces the body to a 10th of its weight. In general, the fluids are to the solids as 8 or 9 to 1.

A female skeleton of the same age is smaller than a male. The head, hands, and feet are smaller, the neck longer, the pelvis wider and deeper, and the prominences less.

The pelvis of the female is to that of the male as 5 to 4, in every dimension.

The Englishman's skull averages 7 inches in diameter, and the female 6¾ inches. Yorkshire, &c. averages 7½ inches; and Scotland 7¾ inches.

The length of the head from the frontal to the occipital bone is about 5 inches; the

breadth is 4·5. The heighth is 4·25 inches. The vault is flat, oblong, or conical.

The Belgic skull is the most oblong and globular. The German, Italian, and Turkish, the most spherical. The English are most prominent in the occipital, the Italians in the parietal. The French forehead is the most vertical. The Italians most elevated. The Calmucs all prominent, but the frontal flat, and cheeks high.

In the area of a vertical, or face direction of the cranium, to the lower-jaw, and a horizontal or cranial area, the cranial in the European is to the vertical as 4 to 1. In the Negro 10 to 3. In the Calmuc 40 to 11. In the ape and pig 2 to 1, and it varies in all. In man the cranial section is an ellipse, and the facial a triangle, whose base is less in other animals.

The facial angle is the horizontal angle formed by a line, parallel to the bottom of the nose, with another line from the level of the upper-jaw to the ridge of the frontal bone. It is

In Europeans, from 75 to	85
In American Indians....	73½
In Africans	70
In ourang-outangs	55
In monkeys	57
In dogs	40
In sheep	30
In a horse	23

The Indians west of the Rocky Mountains flatten the heads of their children by compression, for a whole year, and apparently without injuring the functions of the brain.

In two men, 68 and 71 inches high, the distance between the tips of their middle fingers was respectively 68 and 73·75 inches. From the top to the pubes 34 and 35. Top of the shoulder and elbow 12 in each, from the elbow to the wrist 10 and 10·5. Thigh 14 and 17. Knee to the sole 18 and 20. The foot 9·75 and 10. Women are from 5·25 to 5·4 or 5·5 feet. Above is tall.

A man is taller in the morning than at night, to the extent of half an inch or more, owing to the relaxation of the cartilages.

The belief of the existence of races of giants is accredited by the Bible and Sanchoniatho. There are, sometimes, men 7, 8, or 9 feet high: and, among savage tribes, this adds to their ascendancy, and assures the rank of chief. All buildings, door-ways, passages, &c. indicate, however, that 5 feet 8 inches, or 5 feet 9 inches, have always been the average heighth of the human race. Genesis tells us of "Sons of God" who were giants, of the men of *Anak*, to whom the Jews were as grasshoppers; and the Bible tells of Og, king of Bashan, who was 13½ feet high, and Goliah 11 feet!

There appear, however, to have been races 8 or 10 feet high, used as oigs (ogres) or champions; and all history lies if there was not such a race in and near Lebanon, some of whom were employed in ancient armies, while others emigrated to Ireland and Cornwall, among Phœnician colonists.

The Esquimaux and Bosjesmen attain but 4 feet 3 inches, and the Mongol Tartars and Kamtshadales but 4 feet 9 inches. The Caribs are 5 feet 11 inches, the Navigators Islands 5 feet 6 inches, and the Patagonians 6 feet 7 inches, and upwards.

Complexion and Hair of Men.

A fair complexion arises from the transparency of the skin, which shews the blood in the cutaneous tissues. In warm climates they become red, but dark persons in Europe become yellow in the tropics.

The skin consists of three laminæ, the cuticle, the rete mucosum, and the true skin. The rete mucosum is a coagulated substance, lying between the two others, and giving the external colour to the body, but constantly adhering to the transparent and porous cuticle.

The colour of the skin depends on substances exterior to the true skin, or hide, which is always white. The rete mucosum between this and the outer, or scurf-skin, is a secretion from the true skin, or vera cutis, and is the seat of colour. It is an irregular net-work, and with difficulty separated from the vera cutis beneath, or the scurf-skin above. But, after death, in blacks it may be washed away like the pigment of the iris, which it somewhat resembles. It is less obvious in white races; but as a mucous secreted between the skins, it gives the shades of colours.

The blood of blacks and whites is the same colour, and the darkening of the rete mucosum is ascribed by Blumenbach to carbon, and to the increase of bilious secretions in hot climates.

The children of the blackest Africans are born whitish. In a month they become pale yellow. In a year brown, at four dirty black, and at six or seven glossy black. The change is in the mucous membrane, below the cuticle. Portuguese, Spaniards, &c. living near the equator, in several generations, are almost as black as Negroes.

Red or white haired persons very seldom have black eyes, but blue or grey. When the choroid is red, it arises from the absence of the pigment of colour, and such are called Albinos. There have been cases of the pigment coming and making blue eyes.

The agitation of the eyes of Albinos arises from their sensibility to the solar light.

Grey or blue eyes, at birth, often become brown.

In regard to the colour of their hair, mankind are divided into the black, or melano comous; the red and yellow, or xanthus; and the white, or leucous, with red eyes and white skins called albinos.

The hair rises from roots in the cellular membrane below the cutes. The external part is horny, and the centre is vascular and susceptible of changes. The colour arises from secretions in the root of the same colouring pigment as appears in the iris.

The hair is woolly, straight, black, bushy black, brown, red, flaxen, and auburn.

The Human Voice.

As all animals have means of communicating their ideas and passions to one another, and some by vocal sounds, so man used the means afforded by his peculiar flexible organs, and hence that vocabulary which analysis has reduced to generic words and grammar. The most copious language then spread, and its words were adopted, and hence the similarity which puzzles much idle research.

The wind-pipe is composed of sixteen or eighteen cartilaginous rings, about the twelfth of an inch broad, and joined by elastic ligaments.

The larynx, or organ of voice, is a cavity composed of moveable pieces, twice as large in men as women. Its five cartilages are moved by eight pair of muscles, and fifteen other pairs are connected with its varied powers.

M. Maingault states, that, in experiments made on the larynx, he observed that when air is forcibly thrown into the lungs of a dead infant or animal, the air, in passing out again through the larynx, produces a sound analogous to that in the living state.

Language is another test of distinct races, and the Malay, Chinese, Sanscrit, Arabic, Sclavonic, Etruscan, Welsh, Araucanian, and some others, accord with colour, hair, &c. indicating fifteen species.

In experimental researches into the physiology of the human voice, by Bishop, the following conclusions are deduced :—

1. The vibrations of the glottis are the fundamental cause of all tones. 2. The vibrating length of the glottis depends conjointly on the tension and the resistance of the vocal ligaments, and on the pressure of the column of air in the trachea. 3. Grave ones vary directly, and acute tones inversely, as the vibrating length and tension of the vocal ligaments. 4. The vocal tube is adjusted to vibrate with the glottis by the combined influence of its variations of length and of tension. 5. The elevation of the larynx shortens the vocal tube; and its depression produces the contrary effect. The diameter and extension of the tube vary reciprocally with the length. 6. Falsetto tones are produced by a nodal division of the column of air, together with the vocal tube, into vibrating lengths. 7. The pitch of the organs, when in a state of rest, is, in general, the octave of the fundamental note.

Vital Parts of Man.

The human body consists of—

240 bones,
9 kinds of articulations or joinings,
100 cartilages and ligaments,
400 muscles and tendons,
100 nerves;

besides blood, arteries, veins, glands, stomach, intestines, lungs, heart, liver, kidneys, lymphatics, lacteals, and three skins,—the epidermis, the rete mucosum, and the true skin, beneath which is the tela cellulosa.

Lime combined with phosphoric acid is the basis of animal bones, and is found also in the fluids. Till lime appeared in the strata there were no bones or shells.

Shells consist of carbonate of *lime*, and their remains have been considered as the basis of lime-stone mountains.

The vertebral bones in man are 29 or 30, of which 24 are separate or true vertebræ. The length is nearly uniform in all statures. If the spinal chord be divided at the occipital bone and atlas, above the phrenic and intercostal nerves, instant death follows.

The costal vertebræ, in men, and many animals, are 12. In others, from 11 to 23. The lumbar vertebræ vary from 2 to 9. The vertebræ, including those in the tail, are as high as 60 in the whale tribe, and 50 in some quadrupeds.

Vertebrated animals, or those with a brain and spinal cord, have a muscular heart, lungs, and warm red blood, with venous, or returning circulation, connected with the liver and biliary system. They live in an atmosphere composed of oxygen and nitrogen, which elements they fix.

There are 12 ribs in the human body, though sometimes 11 or 13. Seven, the true, are united to the sternum by their own cartilages; and five, the false, only to the seventh and successive cartilages.

The ribs correspond with the costal vertebræ. They are, in general, from 12 to 15, but the horse has 18, the rhinoceros 19, and the elephant and taper 20.

Madder in food stains bones and abstinence restores; and the vessels so palpably convey the matter of bone, that in cases of necrosis, or death of a bone, a new bone is formed as a case to the dead one, which may be taken away when perfected.

The bones in the head consist of—

1. Frontal or coronal.
2. Parietal.
3. Temporal.
4. Occipital.
5. Sphenoid.
6. Ethmoid.
7. Nasal.
8. Ungual.
9. Cheek.
10. Upper-jaw.
11. Palate.
12. Spongy or nostril.
13. Vomer or nasal.
14. Lower-jaw.

There are three sutures, the coronal, the sagittal, and the lamboidal.

The skull consists of 8 bones, 4 at top, and 4 in pairs at the sides. The 4 at top are the frontal, ethmoid, sphenoid, and occipital. The sides, 2 parietal and 2 temporal.

The bones in the skull of man, and most quadrupeds, are often but 7, owing to the union of the parietal bones; and in the elephant and cetacea there is no suture.

At birth the head is 1-6th of the body; at 2, it is but 1-15th, and at 3, but 1-18th; at 7 or 10, it attains its full weight; at 20, it is but 1-35th of the body. At 70, it often decreases to 1-45th. The head of women is a quarter to half a lb. less than men.

The three kinds of teeth, the incisors, the tearing, and the grinders, are found not only in man, but in the hornless ruminants, all quadrupeds, and thick-hided animals, except elephants. In man alone, the three kinds exactly oppose in each jaw. In carnivora, the canine teeth work by the side of each other in a cavity.

The number of teeth at maturity is thirty-two, or sixteen in each jaw. The eight front ones are called cutting-teeth; and the two next on each side are called dog, or eye-teeth. The two next are two pointed teeth; and the three next on each side are called molares or grinders. The two last are called wisdom-teeth, as they are cut last. The four front teeth in each jaw come first, in eight or ten months; the four canine or eye-teeth in ten months; the sixteen grinders from twelve to fourteen months. At twenty-two or twenty-four years, four other grinders come, making thirty-six. Teeth are phosphate of lime and cartilage, but the enamel is without cartilage. The teeth of an adult have a specific gravity of 2·27, and those of children 2·08.

On the average, the front, molar, and central incisor teeth are renewed at 7 in the lower jaw, the canine at 11, the second molar at 13, and the third molar at 18 or 19, called wisdom.

The human teeth are incisores, or molares, and not like those of carnivorous animals. Man, too, has a cœcum at the upper end, such as herbivorous have, and not carnivorous.—*Wallis.*

The perspiration of a man in health is 28 ounces in 24 hours. It diminishes while eating, but increases during digestion and sleep. The odour varies in different parts.

Urine clears the system of superfluous nitrogen. It is generally half the weight of liquid and solid food, and contains all the salts received in the food. Its specific gravity, in health, is from 1·005 to 1·03, but in disease is 1·05, by Newman's hydrometer. The solid matter is 0·07, or in diabetes 0·09.

Water evaporates from the lungs and the skin, carrying with it none of the salts contained in our daily food, and accompanied by scarcely any animal matter, or organic products, besides carbonic acid.

With the exception of carbonic gas, of lactic acid, saliva, mucus and bile given off from the several secreting glands or membranes, the products of all the various chemical actions going on in every part of the body, and all substances absorbed, but not retained in the blood, appear in *the urine;* which ordinarily amounts to half the weight of the solid and liquid food.

A hundred ounces of urine usually contain, in solution, 7 ounces of solid matter; diabetic urine may contain 9 ounces. In the same weight of cerebral matter there are 20 ounces of solid.

1000 parts of urine contain 30 of urea; 1 of uric acid; 17 of free lactic acid, lactate of ammonia, and animal matter; 17 of phosphates, sulphates, chlorides of potash, soda, and ammonia; 1 of phosphate of lime and magnesia; and a trace of silica.

Action and re-action are in nothing more obvious than in the animal structure, every motion and function being performed by exactly similar *pairs* of muscles, and one side is also exactly opposed to the other side. The only difference is in the viscera, in which the agency of oxygen and nitrogen require a heart on one side, and liver on the other side; but even these contribute to one result in the circulations.

The cause of muscular contractility has produced numerous theories, in which anatomists have regarded the power of muscles as powers *per se!* Nervous agency has also produced numerous theories, the nerves being considered separate from the general identity of the animal! Sensorial power has also been examined as a property of the substances, and not as a personal result!

Muscular force is produced by the drawing up or swelling of the muscles in the middle, and dilating again. The entire muscular system to the ground concurring by its vigorous re-action, is called health. Those muscles which perform involuntary motions, receive nerves from the spinal marrow and cerebrum, and those voluntary from the cerebellum.

A muscle consists of 3 parts, muscular flesh or belly, fascia, and tendon—the two last attachments brought together by the swelling or contraction of the belly.

The head has 77 muscles.

8 for the eyes and eye-lids.
1 for the nose.
8 for the lips.
8 for the jaw.
11 for the tongue.
11 for the larynx.
11 for the ear.
17 for motions of the head and neck.
1 to move the hairy scalp.
1 the eye-brows.

The chest, abdomen, and loins 17. The shoulder 15. The arm and wrist 15. The hand and fingers 23. The hip 10. The thigh 14. Leg and foot 24.

The muscles of the human jaw exert a force of 534 lbs., and those of mastiffs, wolves, &c. far more.

Contracting muscles are called *flexor* muscles; expanding muscles *extensor;* the pair *antagonist.*

Man has but 2 muscles in the coccyx, but in the tails of some animals they are 8 in number.

The circulatory system consists of the heart and arteries; and of the veins and lungs. The compression, or systole of the left auricle, forces the red blood into the arteries; it is then brought back purple by the veins to the right auricle, compressed by it through the lungs, and, reddened and vivified, is passed by the pulmonary veins to the left auricle, which expels it again through the arteries. Such is the economy of all animals, the greatest and the smallest.

The *Tendo-Achillis* is the union of several tendons inserted in the *Os calcis.*

The diastole is the expansion of the heart, &c.; and the *systole* is its contraction.

The right auricle of the heart is larger than the left. The 2 ventricles are equal. The blood found in the right ventricle, after death, is from 2 to 3 oz.

The liver, the pancreas, and the gall-bladder, form a system of large organs, whose purpose is unintelligible, except as assimilators of the nitrogen fixed in the blood through the skin. The oxygen passes by a more simple process to the lungs, and is assimilated to the nitrogenated blood.

The liver occupies the right hypochondrium, within the false ribs, and lies under the diaphragm and above the stomach. It is smallest in healthy persons.

The spleen, of which the use has not been discovered, is found in all vertebral animals. It is always near the stomach, and near the first in those that have several.

The gall-bladder in the human subject is in the shape of a pear, and the size of a hen's egg. It lies on the concave side of the liver. It sometimes forms calculous secretions, which pass to the duodenum.

A healthy liver weighs nearly 4 lbs., but diseased ones four or five times heavier.

The diaphragm is the membrane which divides the thorax from the abdomen.

The chest, filled by the lungs, extends from the neck to the pit of the stomach, and is lined with the pleura.

The lungs are spongy substances. The right lung is divided into three lobes, and the left into two. They are of lighter colour in youth than age, glossy and elastic. They join the wind-pipe, heart, and spine, but in other parts are free. They are composed of cells, of innumerable ramifications of blood-vessels in the cells, for exposure to the inspired air, and of nerves, &c.

In animals with double circulation, the venous blood is dark Modena red, but the arterial is light Scarlet, and is the fluid on which depend excitement and sustenance. Venous blood is to water as 1049 to 1000, and arterial as 1052. Disease makes it lighter, but in full health it rises to 1126.

In man, its temperature is 98 degrees, in sheep 102, and in ducks 107, and the arterial is higher than the venous. In ague it falls from 98 to 94; in fever rises to 102 or 105.

In man, the red particles are the 5000th part of an inch. In birds larger, more so in reptiles, larger still in fish.

The term, circulation of the blood, is incorrect. It is a mere distribution by the arteries, for the purpose of feeding the organs and extremities: and a re-assemblage or absorption by the veins. It is, therefore, not as taught by the schools, a revolution in a circle of tubes. Nor is it the same fluid, for at each extremity it suffers great changes. At the extremities of the arteries it is deoxydized, and rendered alkaline by the nitrogen of the atmosphere; and at the extremity of the veins it is oxydized by the process of inspiration.

Anatomists abandon Harvey's hypothesis about the circulation of the blood. No actual connection of arteries and veins at the extremities of one, and the commencement of the other *can be seen*, even with the best microscopes! The arteries become so fine, as to have even no membraneous walls, and the blood passes into the solid parts, or into the filamentous or cellular tissue, where it is taken up by the venous tubes and lymphatics. Arteries are in a state of positive, or oxygenous electricity from the lungs; and the veins in negative or nitrogen electricity from the skin. The only connection is in some fine capillary vessels, too minute even for the passage of red blood.

Harvey's circulation, by the pretended continuity of the arteries and veins, resembled that hair of Christ shewn by a priest, for the existence of which he demanded *faith* without vision. The truth is, that in Harvey's time, the electrical action and re-action of oxygen and other gases were not understood; nor even the compound constituents of air.

The globules, which in serous fluid constitute the blood, are oblate spheroids, 1.5000th of an inch in diameter.

The globules of the blood vary in diameter, according to the organs which supply the blood under examination.

The quantity of pure water which blood, in its natural state, contains, is very considerable, and makes almost seven-eighths.

The vivification of the blood appears to arise from its chemical combination with oxygen, which thereby parting with its previous motion, that motion received by the blood is animal heat, and the power and energy of the system, or the principle and cause of vitality. The arteries distribute universally, and the distinct veins absorb universally, taking up the nitrogen of the air at the skin, and the carbon of the system. Hence, the chemical combination in the lungs, expiration of carbonic acid gas, and restoration of the powers of the blood.

Keill estimates the surface of the lungs at 150 square feet, or ten times that of the external body.

Besides the nitrogen absorbed by the skin, it may be assumed that the hydrogen in the food is converted into nitrogen, since we know that the chyle of the food oxyginates the blood, and employs the oxygen in the food.

In the ordinary respiration of man, 16 or 17 cubic inches of atmospheric air pass into the lungs 20 times in a minute, or a cubic foot every 5·25 minutes; 274 cubic feet in 24 hours, or a cube of 6½ feet each way. The lungs hold 280, and at each expiration 1·375 of the oxygen is converted into carbonic acid gas: in 63 minutes a cubic foot, and nearly 23 feet in 24 hours. The loss in bulk, per respiration, is but ·006 or 0·12 per minute, or only the tenth of a foot in 24 hours. The nitrogen inspired and expired is exactly equal. If then the relative specific heat, or atomic motion of oxygen, and carbonic acid, as the mean of Crawford and Dalton, be taken as 3·65 to 1; and the absolute heat of a cubic foot of oxygen as 8760; the difference between inspired oxy-

gen and expired carbonic acid is 688° for every foot in 63 minutes, 0 53° per respiration, or 688° × 23 = 15824° + 87·6°, or 15911·6° in all, for heat and strength by ordinary respiration per day.—*Phillips.*

The arteries contain more blood than the veins, and the quantity increases with the temperature. The solid part, after coagulation, is the crassamentum, or clot, and consists of the lymph, or fibrin, and the red particles, of which the first is the most important part of the blood, constituting the solid parts of the body and the basis of muscles. On separation, it floats in a fluid called serum or albumen, like the white of an egg.—Hunter ascribed life to the blood, that is, the blood itself is alive! The blood is *a fifth of the weight of the body.*

Serum coagulates in water nearly boiling; and consists of gelatine, soda, phosphate of lime, and ammonia. The cruor contains subphosphate of iron, soda, and albumen.

The heart, by its muscular contraction, distributes two ounces of blood from seventy to eighty times in a minute.

The lungs, owing to the continued local accession of fresh cold air, are the coldest part of the body, for the degree of heat which they generate, is successively carried away by the blood and breath.

The diaphragm, whose action compresses or dilates the lungs, and on which they rest, is a fleshy partition, which divides the chest from the belly. It is arched towards the lungs, but flattens during a strong inspiration, and rises during a strong expiration. The dilating muscles are four, with ten auxiliary; and the contracting are six, with four auxiliary.

In sleep, the respiration is less frequent, and inspirations being greater, snoring results.

A respiration will hold a minute and a half, or more, if taken deep and long.

The blood of each species of animal contains a principle peculiar to each. This principle, which is very volatile, has an odour resembling that of the exhalation of the animal from which the blood was taken. In the blood, this volatile principle is in a state of combination, its odour being then insensible. When the combination is broken, it is easy to recognise the animal to which it belongs. In each species of animal, this principle is more decided, or has more intensity of odour in the male.

Lymph and serum is common to all *blood;* but in insects it is transparent; in caterpillars green; in frogs yellow; in fish it is red in the vital organs, and transparent at the extremities; in man the red particles are too large for some of the vessels, as the coats of the eye, the tendons, and serous membranes. It is deepest red in quadrupeds, and less so in birds, while it varies being deeper in the hare than the rabbit.

Majendi has given a scale of the pulse, which shows that the difference in frequency between that of the infant and the aged is more than double. The scale is—at birth 130 to 140 a minute; one year 120 to 130; to two years, 102.

At birth the pulsations are from 165 to 104; and the inspirations from 70 to 23. From 15 to 20, the pulsations are 90 to 57; and the inspirations from 24 to 16; 30 to 50, the pulsations are 112 to 56; and the inspirations 23 to 11. In general, it is 4 to 1.

Digestion of food into chyme is called trituration, fermentation, putrefaction, and solution by the gastric juice, by different authors. Philip says, it is nervous and galvanic.

The stomach converts food into a pulp called *chyme*, and passing into the intestines, *bile* converts it into a milky substance called *chyle*, in which state the lacteal absorbents convey it to the blood near the heart, through which it passes to the lungs and becomes blood.

Vegetable aliments are gum, starch, gluten, jelly, oil, sugar, and acids.

Animal aliments are *gelatine*, or jelly, *albumen*, as the white of an egg; *fibrine*, or muscular fibres; and *fat:* also *blood* and *milk*.

Absorbents which convey chyle to the thoracic duct are called lacteals; and those which collect other fluids in the system, and convey them to the same duct, are called lymphatics. The lacteals, lymphatics, and their glands, the mesenteric glands, and the thoracic duct, are the absorbent system.

The fluids taken up by the lymphatics are prepared by the lymphatic glands; and the chyle is prepared by the mesenteric gland, before either pass into the thoracic duct, situated on the right side, near the first vertebra of the loins. It ascends to the left side of the neck, and enters the venous system at an angle formed by the subclavian and jugular veins.

Animals are vegetables with a case for the soil, and their roots turned inward to the soil. By replenishing the soil in the stomach, and expelling that which has lost its powers of sustenance, the animal is independent of locality, and loco-motive.

Mr. Rye, weighing 197 lbs., ate and drank, on the average of 12 months, 96 ounces or 6 lbs. per day. Dr. Robinson ate and drank 85 ounces, perspired 44 ounces, urine 36 ounces, and 5 ounces otherwise. In August his perspiration was to his urine as 2 to 1; and, in November, only as 1·2 to 1.

Experiments on Digestion, by Dr. Beaumont, surgeon in the United States army; on a man whose stomach had been externally laid open by a wound.

	H.	M.
Rice, boiled soft, was perfectly converted into chyme in	1	0
Sago	1	45
Tapioca and barley, &c.	2	
Fresh bread..................	3	
Stale ditto	2	
Strong cake......................	2	30
Cabbage, raw	2	30
Boiled (vinegar much assisted its digestion)....................	4	
Potatoes roasted............	2	30
Boiled	3	30
Carrots boiled.....................	3	15
Beet boiled	3	45

	H.	M.
Turnips boiled	3	30
Parsnips ditto	2	31
Apples, sour and hard	2	50
Ditto, sweet and ripe	1	30
Oysters undressed	2	3
Stewed	3	30
Turkey and goose	2	30
Fowls, domestic	4	
Ditto, wild	4	30
Tripe or pigs' feet	1	
Venison	1	35
Beef and mutton, roasted or boiled	3	
Beef, salted	3	15
Pork, broiled	3	30
Ditto, salted and boiled	4	30
Ditto, roast	5	15
Eggs, raw	2	
Ditto, soft boiled	3	
Ditto, hard boiled or fried	3	30
Custard, baked	2	45
Milk	2	
Butter and cheese	3	30
Suet	4	30
Oil	4	40
Apple dumplings	3	
Calf's-foot jelly	0	30

The first portion of the intestinal tube, for the extent of twelve fingers' breadth, is called the *duodenum*. It is in this portion of the intestines that chylification is chiefly performed. The *jejunum*, which commences where the *duodenum* ends, about an hour and half after meal, has distended lacteals.

The great intestine, or *colon*, ascends towards the liver, passes across the abdomen, under the stomach, to the left side, where it is like an *S*, and descends to the pelvis.

The colon, or large intestine, is from 6 to 7 feet long, and 2 inches in diameter. It contains about 250 cubic inches, or the 7th of a cubic foot. The ilium, or small intestine, is from 28 to 30 feet long. The duodenum is a foot long. Hence, the food, after it is converted into chyme in the stomach, passes through 37 or 38 feet of duodenum, ilium, and colon, before its elimination.

There are four species of worms generated in the human intestines: 1. the tænia, or tape-worm; 2. the tricuris; 3. the ascarides; and 4. the lumbricoides. The remedy is bitters, or turpentine, or gamboge.

The Brain and Nerves.

Avicenna, and other Arabians, place the power of reasoning in objects of sense in the brain within the forehead, imagination behind it, judgment in the third ventricle, and memory in the fourth. M. Flourens by his experiments proved that the sensations existed in the cerebrum, and the will in the cerebellum. Descartes considered the faculty of thinking to be in the pineal gland.

Gall considers the brain as a collection of distinct organs, the form and expansion of which distinguish the intellectual powers and predominating passions of individuals. Its functions are three—organic, sensitive, and intellectual; to each of these purposes he assigns a particular organ. He divides the parts of the encephalon into twenty-seven organs, in three classes; those of organic life; those of sensation and perception; and those which relate to reasoning and intellectual energy on the vertex and smooth part of the forehead, which expands as animals advance in intellect.

The most extravagant departure from all the legitimate modes of reasoning, says Bell, is the system of Gall. Without comprehending the grand divisions of the nervous system, without a notion of the distinct properties of the individual nerves, or having made any distinction of the columns of the spinal marrow, without even having ascertained the difference of cerebrum and cerebellum, Gall describes the brain as composed of many particular and independent organs, and assigns to each special faculties.

That perception, memory, volition, and all the mental phenomena, are associated with, or dependent for their proper action on the brain, is not questioned.

Various powers of brain in different animals arise from its relative bulks, or multiplied fibrous convolutions. Physiognomy refers much to the form of the skull, and all common experience judges of mental power by this unanalysed test. Latterly Gall, Spurzheim, Deville, Holm, &c. effect this analysis, and they refer variance of powers and passions to local enlargements. The general principle is little disputed; but doubts are entertained in regard to their details and subdivisions.

The schools determine in set terms that life is *some* principle of activity added by the will of omnipotence to organized structure, and that to man is added an immaterial soul. Hunter, Lawrence, Abernethy, Morgan, Bichat, Adams, &c. are the last physiological writers on the subject. But to organized structure is known to be added atmospheric air, since, without it, no principle of life is developed, or can be continued, and its mechanical activity may be the proximate cause of the will of omnipotence in this case as in all others. Life seems, therefore, likely to be a result of *organic structure and atmospheric air*.

Sensibility and motion originate in the cerebrum. Two columns descend from each hemisphere, one giving origin to the anterior roots of the spinal nerves, and the other to the posterior, also to the sensitive root of the fifth nerve, and this is the column for sensation. These, and the two for motion, join and decussate in the *medulla oblongata*.

The brain consists of globules, slightly elliptical, larger in the grey than the white substance. It contains pulverulent yellow fat, elastic yellow fat, reddish-yellow oil, white fatty matter and cholestrine; besides lactic acid, sulphur, and phosphorus, in the fats. On analysis, all the elements are found in the substance, but chiefly carbon, hydrogen, and oxygen.

The brain itself appears to have distinct functions, like the nerves; the chief part of it may be cut away or removed without affecting the power of voluntary motion, or giving pain, and this part is the *cerebrum*,

which appears to be considered as the organ of sensation. The animal, on its being removed, loses its powers of sensation. But, if the *cerebellum*, or posterior part, is removed, the animal loses the power of voluntary motion. The organ of feeling in this analysis appears to be the *medulla oblongata*, and the adjoining spinal marrow.

The *brain* and heart are the chief instruments of the lungs, and are alike insensible. In the time of Harvey, a young man had his heart exposed by a disease, and Harvey handled it without being felt.

12 pair of Nerves issue from the brain. 1 to the nose, 1 to the eyes, the 3d to the limbs. 4th to 8th to the face, ear, &c. The 9th to 12th to the viscera; and 25 pair extend from the spinal cord as nerves of volition and sensation. The great sympathetic or intercostate is connected by the 6th pair with the brain, and with several ganglions and plexuses, forming a sub-system of its own. The 8th or *nervous vagus*, is the 10th in the above, accompanying the jugular veins, governing the stomach, &c. The phrenic, which governs the diaphragm, arises from the 10th, or 8th, and 12th.

Nerves are not single, and the combination possesses different powers; two filaments being united for convenience of distribution, while their office and their origin are distinct. The tongue, for example, has nervous papillæ for taste, and others for feeling; this sort communicates pain or feeling, and the other the sense of taste. Bell shews that the nerves which proceed from the front and back of the spinal marrow have totally different functions, though they spread through the system in pairs and in contact. Those which issue from the posterior part might be cut without convulsing the muscles; but the mere touching those from the anterior part produces convulsions. One set performs the functions of sensation and the will, exquisitely sensible and universally diffused; the other set are connected with the functions of respiration, circulation, secretion, and muscular motion.

In less complicated animals, the nerves for different purposes are more decidedly distinct than in the higher classes.

When the nerves to any gland are injured the secretion of the gland is modified.--*Home.*

All the nerves, without a single exception, which bestow sensibility from the top of the head to the toe, have ganglia on their roots; and those which have no ganglia are not nerves of sensation, but are for the purpose of ordering the muscular frame.

The notion of a fluid moving backwards and forwards in the tubes of the nerves, equally adapted to produce motion and sensation, is an error.

The nerves which govern the muscles act by experience. They are soft, gray, or whitish non-elastic cords, and in their course display swellings and conglomerations. Without moving, they direct mobility in the muscles, and convey feeling to the organs of sensation, and, in fact, appear themselves to constitute the sensitive and willing being. In this last case, the sensitive being would be to be regarded as the brain and nerves, and the body their subordinate case and covering. The life of the brain appears to be a result of the galvanic action between the lungs and skin.

Whatever be the mode of action in the nerves, its effects are results of education. There are no thinking and acting infants.

The brain is invested with the dura mater, a membrane with arteries.

Within the *dura mater*, and adhering to the brain, is the *pia mater*, a very fine transparent membrane, filled with blood-vessels; but a finer membrane lies above this, called *membrana arachnoidea.*

The brain is called the *encephalon.* Its portions are the *cerebrum*, which occupies the top and front of the skull; the *cerebellum*, which rests on the base of the skull behind, and separated from the cerebrum by a fold of the dura mater; and the *medulla oblongata*, or commencement of the spinal marrow, which projects upward into the centre of the encephalon.

In the fœtus, the first part of the nervous system that is formed is the spinal marrow; the upper part of which is enlarged, and the brain succeeds.

The brain in the fœtus of superior vertebrated animals arrives successively at the same forms in fishes, reptiles, and birds but in the mammiferæ are modifications.

The spinal marrow and brain appear in the fœtus before the blood.

The spinal chord is formed in the fœtus before the brain, and animals are perfect as it is perfect.

The *cerebrum* has three lobes, or round parts; the middle, called the corpus callosum: and it consists of two kinds of matter, the outside reddish-grey, and the middle bluish-white and softer.

The *cerebellum* has two lobes, and is of firmer consistence than the cerebrum.

The *medulla oblongata* lies between the lobes of the cerebellum and the middle lobe of the cerebrum, from which it is separated by a streaked part, the *pons varolli.*

The *spinal marrow* is a continuation of the medulla oblongata, which unlike the cerebrum, has the bluish-white outside and the reddish-grey inside. It is divided down the middle, and enclosed by the pia and dura mater.

The four are considered as the common sensorium. The cerebrum is the organ of sensation, the cerebellum of volition, and the medulla oblongata and spinal marrow extend and conduct their functions to the system. The weight is nearly four pounds in a male adult, and in the female less.

A tenth part of the whole mass of blood is continually in the encephalon.

The nervous system has an intelligence; which has been considered analogous to the web of a spider, or the net of a fisherman. And its precision is palpably a mere effect of education and repeated experience, since none of the powers of nerves and muscles, and none of the useful operations and re-

flected acts of the brain *appertain to infancy*. The uses of the nerves and of each nerve, and of the muscles and of each muscle, are slowly learnt, and then rendered subservient to well-being and the will.

The *first* nerve of the HEAD is provided with a sensibility to effluvia, and is properly called olfactory nerve. The *second* is the optic nerve, and all impressions upon it excites only sensations of light. The *third* nerve goes to the muscles of the eye solely, and is a voluntary nerve, by which the eye is directed to objects. The *fourth* nerve performs the insensible traversing motions of the eye-ball. It combines the motions of the eye-ball and eye-lids, and connects the eye with the respiratory system. The *fifth* is the universal nerve of sensation to the head and face, to the skin, to the surfaces of the eye, the cavities of the nose, the mouth, and tongue. The *sixth* nerve is a muscular and voluntary nerve of the eye. The *seventh* is the auditory nerve, and the division of it, called portio dura, is the motor nerve of the face and eye-lids, and the respiratory nerve, and that on which the expression of the face depends. The *eighth*, and the accessory nerve, are respiratory nerves. The *ninth* nerve is the motor of the tongue. The *tenth* is the first of the spinal nerves; it has a double root and an office; both muscular and sensitive.

The *three nerves of the tongue* perform three distinct functions, and stand related to three different classes of parts. Taste and sensibility belong to the office of the fifth nerve, voluntary motion to the ninth, and deglutition to the glosso-pharyngeal nerve of the tongue.—*Bell.*

Flouruns, Mayo, and Bell, have traced and clearly distinguished between the nerves of the will and motion, and those of sensation or the organs of sense and feeling.

The brains of blacks and whites are the same colour.

The influence of poison is on the nerves, not on the circulating fluids.—*Addison.*

Whatever may be the nature of the impulse communicated to a nerve, pressure, vibration, heat, or electrical action, the perception excited in the brain has only reference to the organ exercised, not to the impression made upon it. Fire does not give the sensation of heat to any nerve but that appropriated to the skin. However delicate the retina be, it does not feel like the skin. The point which pricks the skin being thrust against the retina, will cause a spark of fire or a flash of light. The tongue enjoys two senses, touch and taste; but, by selecting the extremity of a particular nerve, or, what is the same thing, a particular papilla, we can exercise either the one or the other sense separately. If we press a needle against a nerve of touch, we shall feel the sharpness, and know the part of the tongue in contact with the point; but if we touch a nerve of taste, we shall have no perception of form or of place, but experience a metallic taste.—*Bell.*

The sense of feeling is created by the papillæ of the skin, consisting of small white nervous fibres, which erect themselves when the sense of touch is excited.

The sense of taste by the tongue and palate, by means of nervous papillæ.

The organ of smell is in a fine periosteum, lined by mucous membranes, which cover the ethmoid bone and its sinuses and cells, which are more numerous in dogs and carnivorous animals.

The sense of hearing is effected by a mechanism which conveys the vibrations to the internal parts, where nervous fibres are distributed. The drum of the ear is called the *membrana tympanum;* and its vibrations are conveyed to four bones in the internal cavity, which again propagate the vibration to a double spiral cavity, called the *cochlea.*

The eye is an optical instrument. The outer coat is the *sclerotic* membrane. The fore part is the *cornea*, made up of concentric layers. Between this and the former lies the white of the eye, covered by the *membrana conjunctiva*, that lines the outside of the eye-lids.

Within the sclerotica, and concentric with it, is the *choroid* membrane. At the back part it is perforated by the optic nerve, where it forms the *retina*. Three-fourths is filled with the vitreous humour, like the white of an egg. In front is the chrystalline lens, convex on each side, but more so inward. It is composed of transparent laminæ, more dense towards the centre. The front is filled with the aqueous humour, in the middle of which floats the iris, a coloured membrane. The specific gravity of the humours is but a 200th more than water: but the lens one-thirteenth more than water. They consist of water and albumen, and gelatine. The iris is supplied with blood-vessels and nerves, and is very irritable, contracting and dilating to the light, and appearing to be governed by the retina.

Between the ball of the eye and the vault of the orbit lies the lacrymal gland, which secretes tears, and consists of two lobes, with several small canals.

The pigment which colours the iris, is a secretion from the vessels of the choroid.

The humours of the eye vary with the medium in which the animal lives. In fishes, the crystalline is nearly spherical.

Sleep is the arrestation of that *succession* of perceptions and thoughts, which characterizes the active animal. It is the rest of the brain and the nervous system. The retina is powerless, the tympanum is placid, and the papillæ, or ends of the nerves of taste, smell, and feeling, have lost their energy. The cerebellum has no will; the cerebrum no powers of sensation, comparison, or reason; and if we dream, it is the pineal gland, or some auxiliary part, which acts without will or reason.

It is impossible to contemplate the fitness and curiosity of these arrangements, extending as they do through all animal nature, and often rising in contemplation and exact adaptation (in what we consider the meanest

creatures) without bowing our souls with feelings, which no words can express, to that Power, and that Wisdom, which so transcends our own conceptions, as to require a language of its own, and so exalts all sensibility as only to be felt by the wisest of our race. We can examine, and we ought to examine, the details and the laws which govern these wonders, and we may trace some proximate causes; but our investigations, at best, are very crude; and a long life of enquiry ends in over-powering admiration of a sublime scheme of things, infinitely divisible, infinitely expansible—so small!—so large!—so perfect!—yet, when understood, so harmonious in all its details!

Longevity of Man.

Children die in large proportions, because their diseases cannot be explained, and because the organs are not habituated to the functions of life. Half die before 26, and two-thirds before 50. The mean of life varies in different countries from 40 to 45. A generation from father to son is about 30 years. The mean succession of kings is about 22 years, less than a generation, because they often suffer violent deaths, or destroy themselves by vice and indulgence. Of men in general, 5-6ths die before 70, and 15-16ths before 80. After 80, it is rather endurance than enjoyment. The nerves are blunted, the senses fail, the muscles are rigid, the softer tubes become hard, the memory fails, the brain ossifies, the affections are buried, and hope ceases. The 16th die at 80, except a 133d at 90. A remainder die from inability to live, at, or before 100. —*See the Article* POPULATION.

The legends, in ancient writers about longevity for hundreds of years, must necessarily be mistakes of thelia, or errors of translations. Moons for solar years, or dynasties and tribes for their patriarchs, as in Arabia to this day. The elements must have been far less active, if human germs were hundreds of years growing and decaying, and hundreds at maturity, or man of those times could not have had the modern organization. The Persians, Chaldeans, and other orientals dealt in these fables, or they expressed time differently, or they put the name of the founder for a tribe or dynasty. Most of these hyperbolic numbers, divided by 12·5 moons, give rational results. The period of the Moon was observed long before that of the Sun, and used to this day.

In Russia, much more than in any other country, instances of longevity are numerous, if true. In the report of the Holy Synod, in 1827, during the year 1825, and only among the Greek religion, 848 men had reached upwards of 100 years of age: 32 had passed their 120th year; 4 from 130 to 135. Out of 606,818 men who died in 1826, 2785 were above 90; 1432 above 95; and 818 above 100 years of age. Among this last number, 88 were above 115; 24 more than 120; 7 above 125; and one 160.

Riley asserts that Arabs, in the Desert, live 200 years.

The black races on the African coast are short-lived, and old at 45. In the plains of the interior many live to 100. Slaves in the West Indies are recorded from 130 to 150. Burchell mentions Hottentots above 100.

Native Americans often attain 100 and upwards, and Humboldt mentions one of 143, but want of registers are generally fatal to these claims, and reports fallacious.

The proportion of boys to girls born, are, in the average of Europe, 106 boys to 100 girls; highest in Russia, or 108·91, and lowest in Great Britain and Sweden 104·7 to 100. In illegitimate children, the proportion of girls is higher, or 105 to 100. In towns still higher, *i. e.* as 104·46 boys to 100 girls. It seems to depend on the greater age of the father than the mother, for when the father is 50 or 60 and the mother but 25 or 30, the boys are to the girls as 190 or 200 to 100. But when the father is younger than the mother, the boys are to the girls only as 90 to 100. Then, as fathers, in general, are oldest, the boys preponderate.

On the average, men have their first-born at 30, and women at 28, which is, therefore, the term of a generation.

The greatest number of deliveries take place between 25 and 35.

The greatest number of deliveries take place in winter months, and in February, and the smallest in July, *i. e.* to February, as 4 to 5 in towns, and 3 to 4 in the country. The night births are to the day, as 5 to 4.

Of 100,000 male and female children, on a mean of many tables, it appears by Quetelet, that in the *first month* they are reduced to 90,396, or nearly a tenth. In the *second*, to 87,936. In the *third*, to 86.175. In the *fourth*, to 84,720. In the *fifth*, to 83,571. In the *sixth*, to 82,526, and by the end of the first year 77,528, the deaths being 2 in 9.

The next four years reduces the 77,528 to 62,448, indicating 37,552 deaths before the completion of the fifth year.

At twenty-five years the 100,000 are half, or 49 995; at 52, a third. At 58½ a fourth, or 25,000; at 67, a fifth; at 76, a tenth; at 81, a twentieth, or 5000; and 10 attain 100.

Females in towns are not reduced to half till 28, and in the country till 27. Men in towns, at 20½, and in country at 23½. At 5 years also, the females who survive are from 400 to 500 more than the males.

About the age of thirty-six the lean man usually becomes fatter, and the fat man leaner. Again, between the years forty-three and fifty, his appetite fails, his complexion fades, and his tongue is apt to be furred upon the least exertion of body or mind. At this period his muscles become flabby, his joints weak, his spirits droop, and his sleep is imperfect and unrefreshing. After suffering under these complaints a year, or perhaps two, he starts afresh with renewed vigour, and goes on to sixty-one or sixty-two, when a similar change takes place, but with aggravated symptoms. When these grand periods have been successively passed, the gravity of incumbent

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years is more strongly marked, and he begins to boast of his age.—*Waterhouse.*

The grand climacteric in human life varied between sixty and seventy; and was an astrological period, which depended on the revolutions of Jupiter and Saturn, five of one and two of the other.

The catamenia in women appear at 13 or 14, in France. Italy and Spain, at 12. In Asia Minor, at 10 or 11; in Persia and Arabia, 9 or 10; Jamaica and West Indies for whites and blacks, at 9 or 10. In Germany, at 15. In Africa, at 8 or 9, and three days in every third week. In North America, the Indians at 18 or 20, and cease at 40. In South America at 11 or 12, and in California the same.

Puberty, in northern climates, commences from 15 to 20, but in India and Arabia from 11 to 14. Age in the former from 45 to 70, and in the latter from 30 to 45.

Diseases and Medicine.

Cullen divides diseases into 4 classes; pyrexiæ, neuroses, cachexiæ, and locales. These into 23 orders, these into 158 genera, and the genera into various species, 3 or more. The first class includes fevers, inflammations, eruptions, and hæmorrhages. The second, apoplexy, paralysis, vertigo, spasms, and mental diseases. The third class, emaciation, dropsy, and cutaneous. The fourth, defects of sense and motion, discharges, obstructions, tumours, ruptures, &c. Hence the species of human diseases are above 1000 in number.

Dr. Young divides the remedies of the materia medica into four classes; mechanical agents, chemical agents, vital agents, and insensible agents:

1. Air, diet, habits, passions, &c.
2. Caustics, astringents, &c.
3. Excitants, cathartics, &c.
4. Specifics.

The human race are exposed to ENDEMIC diseases, arising from local causes, and miasmatous influence; as goitre, plica polonica, marsh ague, dysentery, and swamp bilious fever, &c. To EPIDEMIC diseases, travelling over a greater or less extent of country, as typhus, influenza, plague, yellow fever; these are usually INFECTIOUS diseases, arising from miasmatous effluvia, of a nature as yet unknown, mingling with the atmosphere. The CONTAGIOUS diseases of animal origin, as small-pox, whooping-cough, measles, psora, leprosy, siphilis, rabies, c. To infectious diseases arising from crowded habitations, scanty food, inattention to cleanliness and ventilation, which render also many diseases infectious that otherwise would not be so; as typhus, dysentery, fevers from filth in cities, from burying-grounds, &c. To diseases arising from other nuisances, as unwholesome trades and manufactures, bad water, &c.

Epidemic diseases are not easily prevented, and they are easily confounded with endemics, which sometimes become epidemic; but more cleanly habits have conquered the leprosy, the plague, the falling sickness, the sweating sickness, and the malignant typhus.

Jackson, of Philadelphia, has shewn in what way the yellow fever can be imprisoned and circumscribed until it be eradicated. It appears that its miasma do not mount over a fence of a dozen feet high, so easily as over an inclined plane 100 feet high.

All infectious and contagious disorders owe their origin to animalculæ; and these have their infancy, their maturity, and their decline. Yellow fever first attacks the stomach; bilious fever the liver; black vomit, examined by a microscope, presents a congeries of animalculæ; the bubo of the plague is full of them; so are the pustules of psora. The rot in sheep seems to be owing to animalculæ.

Water, after producing successions of animalculæ, becomes fœtid. It then affects the lungs, and is deemed the source of pestilential miasmata.—*Dwight.*

Contagion is one of those generic words which, like attraction, bewitching, suction, &c. &c. mislead and obstruct enquiry. "Is not contagion," says Dr. Dwight, "such a fermentation of an animal body as generates animalculæ, and, hence, the danger of contact; and is not exemption, after affection, evidence that the germs in that subject have been exhausted? Do we not subsist on such germs, and is not the class of contagious diseases evidence that they have overcome the usual economy of the subject? The generation of animalculæ, in our microscopic experiments, proves the universality of their seeds or germs."

Dr. D'Arcet has proved that clothes infected by persons who have just died of the plague, are purified by being steeped in a chloruret of soda.

Vinegar boiled with myrrh or camphor, and sprinkled in a room, corrects putridity. Smyth's plan was, to heat half a tea-cup of vitriolic acid in a vessel of hot sand, and stir into it some powdered nitre, till the room is filled with nitrous vapour. The chlorurets of sodium and calcium have lately been adopted.

Quarantine was contrived by the Venetians, in 1437.

Medicine is as old as man, and is used by most animals as by dogs in grass.

Acupuncturation was a valuable discovery of the early Chinese, as well as the burning of moxa. Bleeding was a sequence.

The Egyptians and Phœnicians deified discoverers in physic. Esculapius, or Æsclepius, was one of these, coeval with Menes. The Chaldeans united diseases with the influence of the Stars, and set horoscopes to discover remedies and results.

The Jews acquired crude notions from the Egyptians, but were very ignorant.

Hippocrates flourished in the fourth century, B. C., and extended surgery.

The functions of the several organs were developed by the Greek schools of philosophy, and they discriminated arteries, veins, and nerves. Erasistratus performed dissection, discriminated the functions of the

two kinds of nerves, and discovered the lacteals. Herophilus perfected the knowledge of the brain, nerves, and eye.

The Cæsarian operation was prescribed by a law of Numa, and temples erected to improvers in medicine and surgery.

Augustus exonerated medical practitioners from taxes.

Moschion was the first known writer on Midwifery, in the third century A. C.

Celsus was contemporary with Christ, and recorded the state of medicine.

Archigenes, in the first century, describes amputation, with ligatures and caustics. He also analyzed mineral waters, and distinguished their chief constituents.

Posidonius referred the organs of the mental powers to parts of the brain.

Galen almost perfected medicine as we now have it. He was a native of Pergamus, and died about 200 A. C. He described seven pair of nerves, and distinguished between the hard motive from the spine, and the soft sentient from the cerebrum, also those from the medulla oblongata. He described the motion of the blood through the heart and arteries, with arterial and venous blood. He also described respiration, and likened it to combustion, as the source of animal heat.

In the third century, the eye was explained, and cataracts, &c. treated as at present, by Antyllus and Severus.

A plague occurred with buboes in 531. The small-pox spread through Europe, in 580. The Chinese inoculated for it 100 B. C.

In 1250, Myripsus used quicksilver, and Paul of Ægina, Psellus, and Seth, made minor discoveries down to Paracelsus.

Mondino taught anatomy in 1315. Harvey by tying up veins and arteries, and by considering the direction of the valves of the veins, turned towards the heart, and the absence of valves in the arteries, he inferred the general circulation in 1616.

Ascelli discovered the lacteals in 1622; the lymphatics by Ruysch in 1665.

Lady M. W. Montagu introduced inoculation for the small-pox from Turkey. Her own son had been inoculated with perfect success at Adrianople in 1718. She was allowed to inoculate seven capital convicts, who on recovery were pardoned.

Dr. Jenner made the first experiment in vaccination in May, 1796, by transferring the pus from the pustule of a milk-maid who had caught the cow-pox from the cows, to a healthy child; and, publishing the result, the practice spread through the world.

Previous to vaccination, the annual deaths from small-pox in London were 4000, or about 1 in five or six. Since, they have been reduced 1000.

The deaths from small-pox in London, in the twenty years previous to the promulgation of vaccination, were 36,189; but in the next twenty years only 22,480. In the same periods, in the Small-Pox Hospital, the numbers were 1867 and 814. The frequency of small-pox after vaccination renders it necessary to repeat the vaccination.

The College of Physicians was founded in 1522, and now consists of 420 members.

The College of Surgeons was founded in 1541, and now includes 14,000 members, though 1 candidate in 10 is sent back. The age must be 22, with 5 years' study and lectures for 2 years; 501 passed in 1834.

The Apothecaries' Company was founded in 1616, and consists of 630 members. Certificates are granted to 5 in 6; candidates aged 21, who have served 5 years, and attended 3 winter, and 2 summer courses of lectures; 455 were passed in 1832, and the living members are about 12,000.

The increase of Surgeons in 12 years, is 125 per annum, and of Apothecaries, double. The gross living number of those passed by the 3 branches in London are about 26,400, besides half as many from Edinburgh, &c. &c. making full 40,000.

There are schools also at Bath, Birmingham, Bristol, Hull, Leeds, Liverpool, Manchester, and Sheffield.

There are 14 authorized schools for lectures in London, besides 11 private schools.

There are 9 great general Hospitals in London, and 5 for special objects; 5 museums, and 3 medical libraries; 4 infirmaries, and 11 dispensaries, in which last 40,000 receive relief; also 68 hospitals, infirmaries, &c. in the counties of England.

There are 11 medical institutions in Edinburgh, 13 in Glasgow, and 3 at Aberdeen; 9 in Dublin, besides 31 county infirmaries in Ireland, which constantly provide for 900 with 5 or 6 weeks' treatment.

The mixed and fanciful diet of man is considered as the cause of numerous diseases, from which animals are exempt. Many diseases have abated with changes of national diet, and others are virulent in particular countries, arising from peculiarities. The Hindoos are considered the freest from disease of any race.

It has been computed that nearly two years' sickness is experienced by every person before he is 70 years old, and therefore that ten days per annum is the average sickness of human life.—Till forty it is but half, and after fifty it rapidly increases.

So great, says Dr. Currie, are the difficulties of tracing out the hidden causes of disorders, that the most candid of the profession have lamented how unavoidably they are in the dark, so that the best medicines, administered by the wisest heads, often do the mischief they were to prevent.

The same medicines have contrary effects primarily and ultimately, and, as applied to different functions of the system. Thus opium is at first stimulating, and then sedative. Cayenne and black pepper are inflammatory stimulants of the skin, but remove inflammation of the palate. Turpentine excites the skin, but operates as a sedative in puerperal fever and on the kidneys. Digitalis diminishes the action of the heart and arteries, and increases that of the absorbents. So with others.

Pritchard ascribes local or endemical diseases which affect natives, and not fo-

-eigners, to the identity of climate, &c. with constitution.

As the animal system does not admit of two excitements at the same time, most morbid affections are relieved by new excitements; and these abating, the disease abates, and is often cured. This is called sympathy, and the stomach and brain appear to be the common centre of it.

Diseases which affect all men are not communicable to any animals; and so the diseases of animals do not affect other species. The similarity of human diseases is deemed a proof of similarity of species.

In *Ausculting*, the stethoscope should be held in the hand lightly, and fixed flat on the skin; the small opening corresponding to the external opening of the ear. The *respiratory* murmur is at its *maximum* in *infants;* in the *healthy parts* of a lung partially hepatized; at its *minimum* in old people; perfectly healthy lungs sometimes give no respiratory sound. The sound is heard most distinctly in the auxilla, between the clavicle and the anterior border of the trapezius, between the clavicle and the breast, posteriorly between the vertebral column and the border of the scapula.

On striking different parts of the body, various sounds are produced, dull or clear in proportion as the subjacent parts contain more or less elastic fluid. The pulpy ends of the middle and forefinger are employed to strike, and the ivory plessimeter, a piece of leather, or the second plinth of the forefinger of the left hand, is placed on the part to be struck. On the surface of the body the following scale of sounds may be distinguished, beginning with the dullest; the femoral, the jecoral, the cardial, the pulmonal, the intestinal, and the stomachal, the clearest of all. Besides these, there are the osteal, the humoric, (when organs are filled with air and liquid,) the hydatic, and noise, where a cavern is filled with air.

Lamb infers, from the teeth, stomach, and intestines of man, that his natural food is vegetables. Other anatomists have maintained the same opinion, and many philosophers, in all ages, have proved the advantages of vegetable diet in their continued good health and extraordinary longevity.

If there be any universal medicine in nature it is water; for, by its assistance, all distempers are alleviated or cured, and the body preserved sound and free from corruption, that enemy to life.—*Hoffman.*

Lettsom ascribed health and wealth to water, and happiness to small beer, and all diseases and crimes to the use of spirits: making, of the whole, a moral thermometer. The Abbé Gallani ascribes all social crimes to animal destruction, thus treachery to angling and ensnaring, and murder to hunting and shooting.

Reece enumerates 220 drugs in general use in the relief or cure of diseases. The chief part are derived from the vegetable kingdom; and there are five preparations of steel, three or four of mercury, one of tin, two of sulphur, four of nitre, and twenty or thirty chemical products, as quinine, morphine, iodine, prussic acid, &c.

In diseases the European is the most irritable, and the American the most torpid in constitution.

Persons who die of famine exhibit a foul breath and skin, with no evacuations.—When without food for any number of days, they are inebriated by a basin of broth.

Vegetable poisons are numerous; the *acrid* are briony root, bitter apple, hellebore, spurge, wolfsbane, meadow anemone, narcissus, and ranunculus. The *narcotic*, as hemlock, henbane, laurel, opium, stramonium, tobacco, coculus indicus, fox-glove, nux vomica or ratsbane, meadow saffron, elaterium, fool's parsley, and fungi. The *mineral* poisons are arsenic, corrosive sublimate, oxalic acid, sulphuric acid, nitric acid or aquafortis, verdigris, white vitriol, and white lead. Among the *gases*, carbonic acid, nitrogen, hydrogen, chlorine, &c.

Arsenic and acid solutions of mercury, copper, lead, antimony, &c. are active mineral poisons, for which sulphur and salt of wormwood, or charcoal, are the best antidotes next to the stomach-syringe.

Vegetables poisonous to man provè innoxious to other animals, while some which men eat with impunity are fatal to some animals. Parsley kills parrots; the prussic acid in bitter almonds kills dogs, and some birds: opium and arsenic have a diminished effect on dogs.

One-fourth of the deaths in London are from consumption, and one-eighth of the deaths arise from drinking spirituous liquors, which has been greatly increased by legislative measures.

Diseases of cattle afflict men who subsist on them. In 1515 and 1578, nearly all the sheep in France perished by a disease resembling the small-pox; and in 1599 the Venetian government, to stop a fatal disease among the people, prohibited the sale of meat, butter, or cheese, on pain of death.

As nature does not act freely and always equally, especially in clothed and capriciously-feeding men, so the oxygen absorbed at the lungs, and the nitrogen at the skin, do not exactly balance and neutralize each other. The system is provided with means for discharging the excesses of either within a limit, but when the excess exceeds the natural means of carrying it off, diseases result, and their number and variety in man may therefore be ascribed to his artificial mode of life, and his ignorance of the means by which health is maintained.

The human constitution is not destroyed by heat, but by excessive moisture in the air. Batavia has become healthy since the evergreen avenues have been cut down, and the street-canals filled up. The coasts of Africa and Asia are healthy where open, and destructive when covered by woods and morasses to the sea-side.

Anatomy is the knowledge of the mechanical structure of the parts of the body. *Physiology* treats of the powers by which they produce their results in the living body.

Pathology treats of diseases and their symptoms, the classification of which is called *Nosology*. *Therapeutics* treat of cure, and medicines to be applied, and include the *Materia Medica*. *Pharmacy* is the art of compounding medicines, and *Posology* determines the doses.

Miscellaneous Facts.

Jeffery Hudson, the dwarf, was but 18 inches till 30, and then he rose to 39 inches. Bebe, the Pole, was only 32 inches at his death, aged 23, and slender in faculties. Borulawski was only 28 inches at 22, yet a man of talents.

In Ava, a man was lately living, covered from head to foot with hair. The hair on the face was shaggy, and about eight inches long. On the breast and shoulders it was from four to five. At Ava he married a Burmese woman, by whom he has two daughters; the eldest resembles her mother, but the youngest is covered with hair like her father.

The foot of a Chinese female, from the heel to the great toe, measures only four inches; the great toe is bent abruptly backwards, and its extremity pointed directly upwards: while the phalanges of the other toes are doubled in beneath the sole of the foot, having scarcely any breadth across the foot, where it is naturally broadest. The heel, instead of projecting backwards, descends in a straight line from the bones of the leg, and imparts a singular appearance to the foot, as if it were kept in a state of permanent extension. From the doubling in of the toes into the sole of the foot, the external edge of the foot is formed, in a great measure, by the extremities of the metatarsal bones; and a deep cleft or hollow appears in the soles.

A bicephalous, or double-headed child, named Christina-Ritta, lately excited curiosity in Paris. She was born in 1829, of well-formed parents, and christened at the left bust by the name of Christina the right by that of Ritta. Ritta was more feeble than Christina, and in journies she suffered much more than the other.—Christina-Ritta is double from the head to the pelvis. The two vertebral columns were distinct to their lower extremity—that is, to the coccygis. Below the pelvis it is simple. Thus, there were two heads resting on two necks. The corresponding chests are so disposed that the left arm belonging to Ritta naturally places itself on the neck of Christina, whose right arm placed itself, in the like manner, on the neck of Ritta. The union of the two busts was effected towards the middle of the pectoral cavity, and on the side; so that the two corresponding breasts are almost blended together. The abdomen was single, as is also the pelvis, which is evidently formed by the junction of two primitive ones. Within there were two lungs, perfectly separate; two hearts in only a single membraneous envelope; but the hearts were so disposed that their peristaltic motions must have been in unison. A single diaphragm separated the cavity of the chest from the cavity of the abdomen, and the diaphragm being an organ indispensable to the functions of respiration, the cessation of motion in the part belonging to Ritta paralysed the motion of the part belonging to Christina

The Biddenham maids, born in 1100, had distinct bodies, &c. but were joined by the hips and shoulders. They lived to be 34; and one dying, the other refused to be separated, and died in a short time. They left twenty acres to the poor, still distributed in bread every Easter Sunday.

The Siamese or Chinese youths were shewn in London, joined by a band of cartilage and skin at the stomach, from two inches and a half to four inches long, and eight inches round. They were healthy and cheerful, and one in body, inclinations, and habits. The band of union was considered as an enlargement of the umbilical cord. There was no nervous connexion through the band, and their sympathy of feelings appeared to be the result of habit from infancy to maturity. When both coughed, the band was distended like a chronic hernial sac. The abdominal cavities appeared to communicate, and to have but one peritonial lining; but the viscera are distinct. At the exact line where one began to feel, the other ceased to feel, and there was no point where both felt. They had a fever together, but not equally great, and both had a cold at the same time. Their evacuations were made together. They went to sleep together, and woke together exactly. They played at chess, and differed in ideas about moves—but in habits they were alike, and different in body, though they grew upon one placenta by one umbilical cord.

Seurat, shewn as a living skeleton, in 1825, was 27 years old. He was five feet seven and a half inches high, and his bones were merely covered with his dry parchment skin. The upper joints of the arms were four inches round. The distance from the chest to the back-bone was but three inches. Round the waist was twenty-three inches. The shoulder blade-bones were scarcely an inch asunder. His appetite was good. The pulsation of the heart was visible to the eye. His ribs resembled pieces of cane. The lungs did not appear to be in the chest, but in the lower abdomen.

Rachael Hertz, of Copenhagen, had, between Feb. 1819, and July 1822, 395 needles extracted from tumours in all parts of her body; the breasts, the navel, the thighs, lumbar region, &c. She had for fifteen years been variously diseased, and was supposed to have swallowed the needles in fits of delirium.

A female, who, in 1829, was 42 years of age, and resided at Pynacre, near Delph, had, from disease, not eaten any thing since 1818, nor drank any thing since 1820. Total exhaustion was prevented by damp wrappers.

Total abstinence above seven days is fatal to man; but there are instances of surviving after a longer period. A religious fanatic

in 1789, determined to fast forty days, but died on the sixteenth.

In 1800, a French prisoner, at Liverpool, exhibited a most extraordinary propensity to devour nauseous diet, particularly cats, of which, in one year, he eat 174, many of them while alive.

An Esquimaux boy, supplied by Captain Parry, eat in one day 10½ lbs. of solid food, and drank of various liquids 1¼ gallon. A man of the same nation ate 10 lbs. of solids including two candles, and drank 1¼ gallons, yet they were only from 4 to 4½ feet high.

A soldier of 17, named Tarare, ate 24 lbs. of leg of beef in 24 hours: and, on another occasion, all the dinner prepared for 15.

Cornaro, the dietetic, allowanced himself to 12 oz. of dry food, and 14 oz. of liquids per day, from the age of 40 to 100.

Vegetable aliment, as neither distending the vessels, nor loading the system, never interrupts the stronger action of the mind; while the heat, fullness, and weight of animal food is adverse to its efforts.—*Cullen.*

You ask me for what reason Pythagoras abstained from eating the flesh of brutes? for my part, I am astonished to think what appetite first induced man to taste of a dead carcase; or what motive could suggest the notion of nourishing himself with the putrifying flesh of dead animals.—*Plutarch.*

Nothing can be more shocking or horrid than one of our kitchens sprinkled with blood, and abounding with the cries of creatures expiring, or with the limbs of dead animals scattered or hung up here and there. It gives one the image of a giant's den in romance, bestrewed with scattered heads and mangled limbs.—*Pope.*

Anthropophagi, or feeders on human flesh, have existed in all ages, and still exist in Africa, and the South Sea Islands. Diogenes asserted, that we might as well eat the flesh of men as the flesh of other animals. The Greeks inform us, it was a primitive and universal custom. Some of their gods lived on human flesh, and the Cyclops did the same. Aristotle and Herodotus name various nations who preferred human flesh to that of animals. The Giagas, and several African nations, have the same preference; and we remember the practices at Owyhee, New Zealand, &c. &c. Human flesh has the flavour of hog's flesh, and veal.

Voltaire says, that, in 1725, he saw four savages from the Mississippi, one of whom, a female, admitted that she had eaten men; but contended that victors ought to have the preference over wild beasts.

St. Jerome states, that he saw Scotchmen in the Roman armies, in Gaul, who fed on human flesh as a delicacy.

At Dailly, in Ayrshire, a miner was entombed without food for 23 days, and found alive; but he died within three days.

The poison so freely administered by Italians, in the 17th century, was called *aqua tofana*, from the name of the old woman Tofania, who made and sold it in small flat vials, which she called manna of St. Nicholas, on one side of which was an image of the saint. She carried on this traffic for half a century, and eluded the police, but, on being taken, confessed that she had been a party in poisoning 600 people. Numerous persons were implicated by her of all ranks, and many of them were publicly executed.

The Kroo nation, on the African coast, travel and perform the hard labour of the other tribes, at such low wages as provides them with rice, their only food.

Infanticide is practised in many countries, but, in some of the South Sea Islands, it is practised by a society called the *Earowies*, which consists of heads of families.

In marching, soldiers take 75 steps per minute, in quick marching 108, and in charging 150 steps.

A man from 16 to 30 can jump 7 feet, and rise 3 feet.

The Hindoos have the art of personating death, so as to deceive able surgeons.

In pearl-diving the common immersion is a minute, but often 90 or 100 seconds. Two minutes is uncommon.

The French, says Lavater, have no traits so bold as the English, nor so minute as the Germans. I know them chiefly by their teeth and their laugh. The Italian I discover by the nose, small eyes, and projecting chin. The English by their foreheads and the weakness of their hair. The Germans by the angles and wrinkles round the eyes, and the cheeks. The Russians by the snub nose and their light-coloured or black hair.

The perception of a woman is as quick as lightning. Her penetration is intuition; almost instinct. By a glance she will draw a deep and just conclusion. Ask her how she formed it, and she cannot answer the question. While she trusts her instinct she is scarcely ever deceived, but she is generally lost when she begins to reason.—*Sherlock.*

100 Quakers buried at Chesterfield averaged the age of 48 years, but 100 others averaged only 25 years and 2 months, proving the value of regular and sober habits.

The number of ova in the ovarium of the human female, is generally 23. They remain the same size through life, unless one is disturbed by impregnation of the male, when it becomes the germ from which is nurtured and raised the future being.—*Malpigi.*

As this period extends about thirty years, so it affords time for the maturing or developing of the 23 or 24 ova. The fact, however, is fatal to all population theories, and all speculations founded on lengthened duration of life, since this is a period of propagation fixed by a law not to be passed, and not dependant on duration of life, while the sexes are equal in numbers.

The human figure is equal to ten faces. One-third from the crown to the forehead; one to the chin; to the pit of the collar-bones two-thirds; from the pit to bottom of the breast one; from the bottom of the breast to the navel one; from thence to the privities one; to the knee two; the knee half; from the lower part of the knee to the ancle two; and to the sole half: in all ten. When the arms are extended, the distance of the tips

of the longest fingers are equal to the height. From one side of the breast to the other is two faces; from the shoulder to the elbow two; from this to the root of the little finger two. The sole of the foot is a sixth of the heighth. The thumb equal to the nose. The teats and pit between the collar-bones of a woman is an equilateral triangle. The length of the face and hands is equal. Such are the proportions of painters and sculptors in perfect figures.

The non-naturals are air, food, and drink, sleep and watching, motion and rest, the passions, and the secretions and excretions.

There are estimated to be 140,000 deaf and dumb in all parts of Europe, and about 6000 in the United States.

In Europe, 1 in 1537 are deaf and dumb. Ireland, 1 in 1714; in the United States, 1 in 2000; but, in Switzerland, 1 in 503. Europe has 114 institutions for their instruction.

MAMMALIA.

MAMMALIA are vertebrated organizations, with lungs for breathing, warm red blood, a heart with two ventricles and two auricles, a diaphragm, teats or mammæ for giving milk, hairy or smooth skin, and viviparous

The cervical vertebræ are seven, attached before to a sternum, with cartilages, and commencing from the suspended shoulder-blade. To these are annexed the *humerus*, or upper arm, with a fore-arm consisting of a *radius* and *cubitus*, finished by a hand of metacarpic bones and fingers; or by *phalanges* with nails or hoofs.

The hinder or posterior extremities are attached to the spine, so as to form a girdle or pelvis, which again is divided into the *ilium* attached to the spine, next it the *pubis*, and behind it the *ischum*. Their point of union is the articulation or junction of the *femur* or thigh, connected with the leg compound or two bones, the *tibia* or skin, and the *fibula*. The foot resembles the hand, called the *tarsus*. *Metatarsus*, or five toes with nails, and three joints or articulations, but varying in number and forms into talons. These forms of termination distinguish between carnivorous and herbaceous, the former having prehensile organs, and the latter having no prehension with hoofs.

The head is united to the *atlas*, or first vertebral joint, and the brain has two hemispheres, united by medullary laminæ, called *corpus callosum*, which has two ventricles and four pair of tubercles, the corpora striata, optic *thalami*, *nates*, and *testes*. The optic thalami has a third ventricle, connected with a fourth below the *cerebellum*, which last is connected with the *medulla oblongata* by the *pons varolii*

In all mammalia the eye and ear are similar. The latter has its *cavitas* and *membrana tympani*, its *pharynx*, and its *eustachian* tube. The *cavitas* has four small bones called the *incus* or *anvil*, the hammer, and the stirrup. The *cranium* itself has three compartments, the two *frontal* bones and the *ethmoid*, the *parietal* and the *sphenoid*, and three the *occipital*. The tongue is attached to the *hyoid*, and suspended by ligaments.

Their lungs are two, composed of cells, and lodged, without adhering, in the cavity of the ribs; and *diaphragm*, which is lined by the *pleura*.

Motion, or force, is effected by muscles attached by ligatures to the bones, and acting or reacting by pairs, like two animals in the envelope of one skin, and joined by the spine or vertebra.

Mammal (or *Mammalia*, plural) from *mamma*, signifying a breast or udder, denotes those animals which suckle their young. Quadruped excludes man and the cetaceous tribes, and comprehends the lizards, tortoises, and other reptiles not Mammalia. Mammals compose a *class*, or primary division of the animal *kingdom*.

The number of species of Mammiferous animals of different authors, are,—

Linnæus	230
Pennant	412
Buffon	333
Gmelin	440
Desmarest	662

Illeger, the last writer, divides the Class into 14 Orders, 39 Families, and 125 Genera.

Demarest assigns 88 species to Europe, Asia 119, Africa 107, and America 235. The Oriental islands and Australasia 84. The cetacea and seals are 42.

Late descriptive catalogues contain 900 species, and recent discoveries raise them to 1200.

Only 13 species have been subjugated to the service of man, which have branched into 112 varieties.

There are 42 Fossil species.

Taking the human species as 4, Desmarest makes the Quadrumana or monkey species 141, the true Carnivora 147, the Ruminantia 97, the existing Pachederma 55, and various Carnivora at 177.

Lamarck's system is founded on the principle of progressive developement from simple to complex forms, and it preceded the discoveries of Geology.

A natural order comprises those which, like the rat, the squirrel, the rabbit, and the guinea-pig, have only two large teeth in front, which they continually employ in gnawing whatever falls in their way; they are, therefore, called *Rodentia*, or gnawers.

These, in the number of their incisor teeth, form the link which connects the *Carnivora* with the *Edentata*, which have no front teeth, and therefore live entirely upon vegetables, or upon soft substances which require little mastication.

The orders of *Carnivora*, *Rodentia*, and *Edentata*, together with the *Ruminantia* or ruminating animals, and the Cetacea or whale kind, compose the *class* MAMMALIA, which are divided into unguculated with nails, unguculated with hoofs, and nectopode or web-footed, already described.

The smallest mammiferous animal yet known is the minute shrew, (*sorex exilis*)

which weighs but half a drachm; the smallest animal of the stag kind is the pigmy musk, the legs of which are but two or three inches long, and no thicker than a tobacco-pipe; and the *smallest* of birds is the *trochilus minimus*, a species of humming-bird, which weighs, when dried, only 30 grains.

These visible beings are, however, as much larger than animalculæ, as the whale, elephant, &c. are larger than they are, yet the same perfection of organization appears.

To smallness there is no limit, but in the size of primitive sustaining atoms, and these in the elements are so small, as, in resistance, to constitute perfect fluidity. In fact, our conceptions, which are relative as to our own dimensions, are as much baffled in our endeavours to estimate the little as the great, the series being infinite each way, and our 5 feet 9 inches, and our Globe itself, being but middle terms.

The following are the mean dimensions of various mammiferes:

Man—4 to 5 feet in Lapland and Labrador, 5½ to 6½ in Europe and Asia, 5 to 5¾ in Africa and America, 6 to 7 in Patagonia.

Ourang-Outang	4½ to 5½	feet
Pigmy apes	2	,,
Striated monkey	5	inches
Vaulting monkey	13	,,
Malbrook	1½	feet
Barbary ape	3½	,,
Sphinx	3 or 4	,,
Dog-faced baboon	5	,,
The preacher	3½	,,
The lemur	1	foot
Vampire	6 to 12	inches
Common bat	4 or 5	,,
Hedgehog	10	,,
The shrew	2½	,,
Mole	6	,,
Badger	2½	feet
Glutton	2½	,,
Racoon	2	,,
Ichneumon	15	inches
Weasel	7½	,,
Ferret	14	,,
Martin	18	,,
Ermine	10	,,
Sable	11	,,
Polecat	17	,,
Zurillo	17	,,
Otter	3½	feet
Lion	6 to 8 and 9	,,
Lioness	5 to 6 and 7	,,
Tails 3 feet, height 3 to 5		,,
Tiger	8 to 9	,,
Tail 4 feet, height 4		,,
Wild Cats	2 to 5	,,
Lynx	4	,,
Civet	2	,,
Hyena	3	,,
Wolf	2½ to 3	feet
Fox	1½ to 2	,,
Jackall	2½	,,
Opossum	15 to 18	inches
Wombat	2	feet
Kangaroo	3 to 4	,,
Flying squirrel	6	inches
Ordinary squirrel	8	,,
Dormouse	6	,,
Marmot	10	inches
Porcupine	2½	,,
Ant-eater	13	,,
Spines	4	feet
Great ant-eater	4	,,
Armadillo and tail	5	,,
Elephant	10 or 11	,,
8 to 10 feet high		
Rhinoceros	12	feet
6 to 7 feet high		
Hippopotamus	12 to 20	feet
Dromedary	6 or 7	,,
9 feet high to top of head		
Lama	6	,,
Musk deer	3½	,,
Stag	4 to 5	,,
Roebuck	3¾	,,
Reindeer	4 to 5	,,
Giraffe	15 or 18	feet high
Chamois	3	,,
Antelope	3½	,,
Pigmy antelope	10	inches
Bottle-nosed seal	11 to 18	feet
Ursine seal	6 to 9	,,
Common seal	4 to 6	,,
Walrus or morse	15 to 18	,,
Manati	20 to 28	,,
Siren	5	,,

There are 90 species of quadrupeds in Europe, of about 42 genera, including 4 cetaceæ; and about 110 genera of birds, including rapacious, fissirostres, dinterostres, climbers, swimmers, and gallinaceous.

Great Britain contains but 60 species of Mammalia, of all sizes and habits.

The great forests of Northern Europe and Britain formerly sustained animals from mammoths to hyenas, bears, wolves, &c. Man has, in countless ages, destroyed them in Britain. Bears, wolves, wild boars, beavers, &c. existed even since the Norman invasion. Our caves, in all parts, exhibit bones of bears as large as horses, hyenas and tigers of the largest size; while the strata expose remains of the elephant, rhinoceros, hippopotamus, and even the kangaroo,—palpably natives when Britain joined the Continent, and when the tropics were wider.

France has wolves, beavers, and wild boars, with some bears. One breed of cats is very large.

Wolves, wild boars, and scorpions, are met with in Italy. The States of the Church contain 247 species of birds. Sicily has termites. Goats supply cheese, milk, and butter. Sheep are scarce, and agricultural breeds neglected.

Spain has a breed of fine horses, introduced from Barbary; also useful mules and large asses. The Merino sheep, once so famous, are now superseded by the Saxon.

Norway has 41 quadrupeds, as the elk, lynx, glutton, beaver, lemming, stag, reindeer, and fallow-deer.

The Swiss ibex, or goat, has horns from 24 to 30 inches. The Alpine spaniel is 2 feet high and 6 long, and useful to travellers. The chamois is of wonderful agility.

Asia has 27 species of of apes, 31 of bats, 110 various quadrupeds, and 38 ruminants.

Elephants are employed in India for

parade, tiger-hunting, and military purposes. Arabia supplies India with the best horses. Indian bullocks are small, with humps; the buffaloes heavy, long-horned, and bare of hair. The Indian ox has a hump of 40 or 50 lbs., active, with a shrill groan.

There are in New Holland 40 species of the Opossum and Kangaroo family, wholly peculiar to that country.

The *kangaroo* is the size of a large sheep, carnivorous and gramnivorous. Their fore-legs are short, and have five fingers. The hind-legs are four feet long, and they stand upright, and run and leap, or rather fly. It uses its short fore-feet as hands, and leaps on its hind-legs 14 or 16 feet at a bound, faster than a dog can run. The kangaroo displays a great maternal feeling. If wounded, she assists her offspring in their escape; and on gaining a place of safety she caresses them to dissipate their alarm. The pouch of the kangaroo and the opossum is a fold in the integuments of the belly, with an external opening, where the young are received in a tender state, and nourished by the paps within the cover.

In New Holland, nature is not only singular, but reversed. Swans are black, and large eagles white. The kangaroo has five claws on its fore-legs, and three talons on its hind ones, yet hops on its tail; moles lay eggs, and have a duck's bill; a bird, the meliphaga, has a broom instead of a tongue. Pears are made of wood, and the cherry has the stone on the outside! Every thing has an original character. All the quadrupeds are like opossums, all the fish are like sharks, and the very land and trees have peculiar features.—*Field.*

Africa is the native country of ferocious and noxious animals, and in the deserts and forests they continue to flourish, after man has expelled them elsewhere.

The animals of America, like those of New Holland, were different from those of the old Continent, though types for the most part. They have had mammoths, but if they had larger animals, they have become extinct. Domestic animals are importations.

There are four classes of *simiæ*, called apes, baboons, monkeys, and sapajoca, in 63 species.

Lepon considers *Simiæ* as the connecting link between man and other animals. The senses are perfect, the brain similar, and their viscera the very same. The Bornese ourang has a perfect human brain. Other of these tribes differ in slight particulars, serving as links in the chain of being. The ourang differs in his muscles, being obliged to use all his limbs for support, the upright posture being irksome. Their maternal and filial affection are affecting. The old ones govern the young, lead them in troops, and chastise disobedience. Some tribes use clubs as men use arms, and their union implies mutual understanding, while the preacher tribe harangue in vocal sounds. In their non-improvement in condition they resemble the black races in Africa, and the aboriginals of the woods of New Holland. In improvements and in arts, certain races of men prove themselves at the head of the animal system.

The monkey tribes live only within the tropics, except a few on the Rock of Gibraltar, as evidence that it once joined Africa; and a few at the Cape of Good Hope; but there are none in Persia, Chili, or Mexico.

The ourang-outang walks erect, and is often six feet high and very powerful, capable of imitating all habits of man. It has no tail. The arms are long, and they use them as legs and hands. They carry clubs for offence, move in herds, and reside in huts made of leaves. Two or three which have been brought to Europe were docile, sensible, imitative, and very affectionate. In Africa they perform labour, and are useful.

The Angola ourang, *simia troglodytes*, is the nearest approach to man, and far more perfect than the *simia satyrus*, or ourang-outang, which in running goes on all-fours.

A noble specimen of the full-grown *pongo* was lately killed under circumstances of peculiar atrocity, on the north coast of Sumatra. He was 7 feet high, and defended himself with resolution and sagacity, till overpowered by balls and stabs.

The Barbary ape, or magot, is known for his agility as an object of exhibition.

In Borneo, Sumatra, and on the Oroonoko, baboons and monkeys are employed to climb trees, and gather ripe fruit.

Different species live in colonies, and distinct species in the same forest without mutual annoyance, and in the same trees with parrots.

The pigmy without a tail is only 2 feet, but ingenious, active, and mischievous.

The mona monkey is a great favourite in India, and they are fed and encouraged in some places. At Amanadab, the Gentoos have three hospitals for them, and at Dhuboy they are more numerous than men, and must be fed, or they do mischief.

The sphinx baboons in Borneo pillage houses, and move in mischievous troops.

The ursine baboon resides in the high lands, near the Cape of Good Hope, and is often dangerous to travellers, carrying clubs and throwing stones with dexterity.

The preacher monkey fills the woods with noise, travelling on the tops of the trees; and one in haranguing the rest, displays perfect sagacity and articulate language.

The most obvious distinction of the Old Continent monkeys and the American, is in the division of the aperture of the nostrils, which in the first are thin, and the apertures close; and in the American thick and wide apart. One also has 10 molar teeth, and the other 12. There are also other constant variations. Types the same, as in many other cases, but differences which indicate distinct evolutions.

The ourang-outang and pongo of the Asiatic Islands, and the African chimpanzee, are the nearest approach to man in external form. They are little like our superior races; but the connection is close with the Bosjesmans, Hottentots, Cretans, and Esquimaux. In bipeds, there are the same

close grades as in other genera. Some small organ is defective in the brain, or some little cord of connection is reversed or wanted, by which results are varied. The facial angle, 100° in the Caucasian races, is but 40 or 45, or at most 60; consequently, there is deficiency in the cerebral organs.

The mandril is often the size of a man, and very ferocious, with coloured cheeks.

The American monkeys (cebidæ) are as various as the African; but all have tails, and some are prehensile, or have fifth hands, with great sensibility of touch. The mycett, howlers or preachers, are the largest.

A dog-faced baboon lately died in the Tower. The right arm was like the corresponding part of the human figure. He used to brandish his pot of porter, and drink it with relish. His attentions to a dog were in the style of patronizing; nor did the dog recognize any difference between the pat of his paw, and that of human friends He sunk under a dropsy, the effect of potations.

The Gossein devotees in India have a school for monkeys, whom they train into regular habits.

The genus atiles has a re-acting great toe, which answers as a thumb, nearly equal, in effect, to the fingers and thumb, and hence they have 4 hands.

The lemur family, in 5 genera, are like the monkey, except in the head, which resembles the fox, and they are less imitative, though in trees as active as monkeys.

The conformation of the mastedon or mammoth was similar to the elephant. Instead of teeth the elephant has enormous tusks, and instead of a nose, a trunk or proboscis, which is a tube of muscles of exquisite sensibility, tapering to the extremity like a little finger. With this trunk he carries food to his mouth, and he drinks by suction. The intestines are extensive, and the stomach simple. The mammoth differed from the elephant in having grinders, and when alive must have been twice the external dimensions, and 8 times the weight.

Young male elephants and females have no tusks, but are killed in wantonness. Teeth imported are generally found cast in the woods. Elephants are from nine to twelve feet high. They swim with ease, with the point of the trunk above water, and live on vegetables. They respire, and eat and drink through the trunk, which is so sensible as to pick up a pea or a pin. The young are three feet high, and the female seldom has twins. They grow for 30 or 40 years, and live 200 or 300, some say 400 years.

The tusk or tooth of the male elephant is harder than horn, and less brittle than bone, weighs from 120 to 200 lbs. and is brought from Ceylon and Africa. 100 parts contain 24 gelatine, and 64 carbonate of lime.

The bones of the elephant destroyed in Exeter Change, under symptoms of madness, were anatomically united. The head is 13 feet from the ground; the top of the back 12 feet. The bones weigh 876 lbs. and the skin 17 cwt.

An elephant bred to war stands firm against a volley of musquetry, and 30 bullets in the flesh will not kill them They eat about 30 lbs. of grain per day, besides sweets, of which they are very fond. They are docile, grateful, intelligent, and most careful. Female elephants assist hunters in making captive the wild elephants.

The Asiatic elephant is more rational than the African.

The Rhinoceros is twelve feet long, with a horn three feet, and a skin so hard as to turn a sabre. They are solitary, and harmless, living entirely on vegetables. One species in Africa has a horn like a cock's spur, rising nine or ten inches, and behind a short thick horn; but another has a horn three feet long, like the unicorn.

The hippopotamus is a very timid animal. Young ones are reared docile. Old ones will tear out the sides of a strong boat.

The behemoth of the Jews was either the hippopotamus or mammoth, said in the Talmud to feed on a thousand mountains in a day; a speed which accords with the Indian tradition about mammoths. When mammoths ranged, man lived in caves.

Under the genus *Felis*, Linnæus classes the lion, tyger, panther, leopard, ounce, ocelot, cat, serval, lynx, and caracal.

The order *Feræ*, or *Carnivora*, have sharp and cutting grinders, as contrasted with tuberculated vegetable feeders, and rough pointed ones in insect feeders. They have acute senses of smelling, and short intestines. The order comprehends lions, tigers, panthers, hyenas, wolves, dogs, foxes, cats, stoats, weasels, and otters.

Bears, weasels, polecats, raccoons, badgers, gluttons, gennets, and civets, are of one family. Bears excavate their caves, or winter habitations for hybernation.

There are three living species of the hyena. That found in caves is extinct. Even this down-looking race has been tamed at the Cape, and is assimilated to the dog.

The claws of lions and tigers are, at rest, drawn within the toes by ligaments.

The tiger and the hyena are the vultures and sharks among quadrupeds.

A lion lived 70 years in the Tower, and another died at 63. There are few now except in Africa, and in N. W. India.

A *Lion-Bait*, by trained dogs, took place at Warwick, in July, 1825. One lion killed two or three with his paws, but would not bite them. Another seized them with his teeth, and held them up with contempt, killing three or four. But a tame lion, bred in a cage, is not a lion of the woods.

Camels weigh from 13 to 14 cwt. The Bactrian camel is the largest, and has two bunches on its back. The dromedary of the Arabians has but one, and is the most common. The bunch on the back is glandular, and not connected with the spine. They move both the feet on the same side, and, therefore, jolt their riders. They require little and coarse food, and live for 10 or 15 days without water. They kneel to take up their load, and carry from 500 to 1500 lbs. Their average pace is two miles and a half

an hour. The deserts could not be traversed without them.

Dromedaries are swifter than Bactrian camels, and without a load go 6 or 8 miles an hour for 10 or 12 hours. Caravans consist of from 1 to 4000, and many Arabs possess 4 or 500. The Tartars employ them in waggons: they cast their hair every year, and it is made into cloths, stockings, shawls, carpets, &c. They live from 40 to 50 years.

The camel in the east is the most valuable servant of man. It eats little and drinks less; the milk makes cheese and butter; shoes and harness are made of his skin; and of his hair tents and clothing. For burthen, he is the ship of the desert.

The horse is believed to be indigenous in Tartary, and there they have the finest breeds, and treat them as of the family.

A horse has 24 grinders, 4 tushes, or single teeth, and 12 front teeth. At five the colt's teeth are shed, and the tushes appear: at six they are grown, and at eight the black marks disappear, and the horse is aged.

Stage-coaches, with their draft, often run 10 or 12 miles an hour. A four-wheel carriage has been drawn 20 miles an hour. Bakewell's black draft-horse will draw above three tons.

Eclipse ran a four-mile heat in eight minutes, carrying 12 stone, and requiring neither whip nor spur, beating with ease every horse against which he was ever matched. He died at 25, in 1789. Childers ran 50 feet in a second, that is 3000 feet in a minute and three quarters, or above 34 miles an hour.

White asses are used for riding, in Bagdad, instead of wheel-carriages, since the streets are mere lanes and alleys.

An American-bred horse, in Feb. 1829, trotted in harness 100 miles in 10 hours and 7 minutes. The driver and vehicle weighed 248 lbs. He had gruel at every 20 miles, was 14 hands, and 12 years old.

In a race near Petersburgh, of 71 versts, or 47 English miles, between two English hunters, and two picked Cossack horses from the Don and Ural, the English beat.

The dziggtai, or Tartary horse, lives in communities, governed by a leader, and never has been tamed. It baffles pursuit by its fleetness, but they are shot and eaten by the Tartars. Young ones cannot be broke, or tamed, and perish in attempts to escape. The zebra, and the quagga, have the same habits, and cannot be tamed or used.

The Bedouins never allow their horses to lie down. All the thorough-bred mares are descended from Mahomet's mare, and no other are highly prized in Arabia. But fine breeds are prized and treated as children.

The mule is the produce of the *male* ass and mare, and the *hinny* of the she-ass and horse. The mule is larger, more like the mare, and the hinny more like the she-ass. Neither propagate with one another. Mules are more hardy and longer-lived than horses, bear heavier burthens, and are more sure-footed.

Spanish asses are often 15 hands high.

Wild asses in Tartary and Thibet live in troops, and keep sentry, being very vigilant; and if attacked, swift in escape. It is the same with sheep, buffaloes, and all gregarious animals.

The Lama is a valuable animal, which supplies the place of the camel and horse in Southern America. They inhabit the Cordilleras of the Andes, but are most common in Peru and Chili. They congregate in large herds, and feed on grass peculiar to the mountains, and as long as they can procure green herbage, they never drink. From the form of their feet, they are peculiarly fitted for mountainous countries, being even safer than mules, and wanting "neither bit nor saddle. There is no need of oats to feed them; it is only necessary to unload them in the evening, at the place where they are to rest for the night, and they go abroad into the country to seek their own food, and, in the morning return to have their baggage replaced, and continue their journey." They carry from 100 to 150 lbs. at the rate of 12 or 15 miles a day.

There are 9 breeds of oxen and 14 of sheep pastured in Britain; 3 of the oxen are British, 3 Scotch, 2 Welsh, and 1 Alderney. Ancient breeds of sheep had horns.

The wild ox, formerly dangerous in British woods, is now only found in the fossil state in recent formations, or in strata with elephants' bones, or in three or four parks as curiosities. It is white, with a black muzzle, and very vicious. The Dun cow of Dunchurch and Warwick castle, was one.

Bullocks perform indifferently with yokes and bows: in France, they draw by the horns. They plough an acre per day with ease. Four bullocks draw three tons of coals; two draw 35 cwt. three miles; and two draw 1020 sheaves, weighing 6375 lbs.

Herds of 10,000 wild *bisons* are often seen on the Mississippi, each herd with its arranged sentinels.

The horns of the Abyssinian ox are nearly four feet long, and seven inches diameter at their base. The Abyssinian buffalo is double the size of our oxen; and two draw as much as four horses.

Bull-fights in Spain are equivalent to the fights of gladiators among the Romans, which at once disgraced and brutalized that people. The amphitheatre for this amusement, as it is called, is 330 feet in diameter, with an area of 225 feet, and sitting and standing room for fifteen thousand spectators. The assailants, called piccadores, are on horseback, and provided with a long spear. The bull soon destroys the horse, and then other combatants carry cloaks to distract the bull till the piccadore has procured a fresh horse.

In 1710, Bullocks weighed 370 lbs., calves 50 lbs., and sheep 28 lbs. In 1832, bullocks weighed 800 lbs., calves 140 lbs., and sheep 80 lbs. There are in Great Britain above five million head of cattle. Each of the inhabitants of London eats or wastes 107 lbs. of meat per annum, Paris 85 lbs., besides poultry, &c., Bruxelles 89 lbs The Chata-

worth ox, four and a half years old in 1831, weighed 220 stone of 14 lbs. or 3080 lbs.

In Malta, oxen are used for draft, mules for carriages; asses are large, sheep are scarce, goats supply milk, &c.

A new species of sheep has been bred in New England. The fore legs are short and crooked, and the bodies long. It is called the otter breed, and if not crossed, it is sustained, but a mixture of other rams, or ewes, produces either species, twins being frequently of both kinds.

The sense of smell is possessed in the highest degree by antelopes. Their herds always have many sentinels. The sight of their large and admired black eyes is acute. Their characteristics are fleetness and timidity; no horse or dog can keep pace with them There are 50 species in Africa, and about 15 in Asia. They vault 12 or 13 feet high, and 10 or 12 yards at every bound. When they lie down, the sentinels examine every bush within a quarter of a mile If surprised, they fight with system, the bucks in front, females a - fawns in the centre.

Beavers are among the most sagacious of animals, and being gregarious, they claim sympathy by their social habits from every man who is a MAN. With their small paws and tails they construct curious habitations, solid and strong. They choose a river, and form a dam across it with perfect foresight as to water-way, strength, &c. contriving to drive strong stakes three feet into the bed. They live chiefly on roots, of which they form magazines for the winter, and sufficient for their village of 18 or 20 tenements. A beaver in the *Jardins des Plantes* was, during severe weather in winter, furnished with fresh twigs of trees, and with apples, &c. On a snow-storm, he cut his supply of twigs into proper lengths, so as to be wove basket fashion, and between the bars of his cage chopped his apples to fill up.

The genus *Canis*, or the dog kind, and the genus *Felis*, or the cat kind, compose the natural *Order* of *Carnivora*, or flesh-eaters, and have six incisor or front teeth in each jaw, and live upon the flesh of other animals.

Dogs, according to Cuvier, are of three species:—1. The New Holland, the French matin, the Danish, the greyhound, and Albanian. 2. The spaniel, hound, shepherd, Siberian, and Esquimaux. 3. The Iceland and Danish, mastiff, &c.

In Britain, there are as many dogs of various breeds as men.

Cats are indigenous in Northern Africa; the Welsh King, Howel, regulated, in 950, the price of cats—a penny and two-pence for a kitten, and four-pence for a mouser. The wild cat was a beast of prey in 1400.

The pole-cat is larger than the male house-cat, and very destructive to poultry, pigeons, rabbits, &c.

Cats on the N. E. coast of Africa change their fur for white hair. The European wild cat is not considered as the original of the domestic cat, but a Nubian which passed through Egypt into Europe. The Angora cat has one eye blue and the other yellow. White cats with blue eyes, when old, are always deaf.

Three Hudson's Bay dogs draw a sledge, loaded with 300 lbs., 15 miles a day. Dogs for draught are now much used in London, and other large cities.

Travelling in the North-west of America is effected by dog-trains. Three dogs will draw a man and his provisions. The traders travel all over the wilderness with them, over unbeaten snow, generally following the course of rivers. The dogs are easily trained to turn, halt, or go by the word of command. When the traveller wishes his dogs to turn to the left, he says, "chuck," and cracks his little whip on the right side of his train; if to the right, he says, "gee," and cracks it on the left side. When they wish them to start or quicken their gait, he says, "march," or *avances*; when they wish to turn short about, they say, *venez ici*, making a motion with a little whip at the same time.

Some dogs hunt by sight, others by smell.

The dog, the fox, wolf, and jackall intermingle their breeds. Jackalls hunt in packs with much noise, and hence drive prey into the haunts of lions, &c.

The dam of the northern foxes will follow those who kill her young for 60 or 70 miles, and howl round them by night and day, till she has in some way avenged herself.

A commission to hunt wolves in the counties bordering on Wales, was granted so late as 1281, and in Scotland 200 years later. The wolves in Russia devour horses, foals, cattle, sheep, &c. In one government, Livonia, in 1823, they destroyed 3000 horses and foals, 2500 cattle and calves, and 16,000 sheep and lambs. Wolves near Hudson's bay hunt in large parties. They surround their prey, or form crescents, and drive them over precipices.

Wolves avoid passing under any thing, therefore shun woods, and seldom pass through hedges. When they cross a river, they follow one another directly in a line, the second holding the tail of the first in its mouth; the third that of the second, and so of the rest. This figure was chosen by the Greeks to denote the year, composed of 12 months following one another, which they denominated Lycabas, that is, the march of the wolves.—*Abbé Pluche.*

There are two sorts of *Goats*; the race of Angora, with hair long and pendant; the other, the goat of Thibet, with hair short and stiff. The former has no down; the latter is covered, and more abundant and finer in those kept on mountains. These two races have produced, by the influence of climate, many varieties. Two importations of the goats of Asia have been made into Germany.

The goats, from whose under-wool Cashmere shawls are made, abound on the dreary table-lands north of the Himalayas. Some have been brought alive to England and France.

In many countries, and on ship-board,

goats for milking serve the purposes of cows. The Swiss, &c. make cheeses, butter, &c. of goats' milk. There are now few in Wales.

Two *Rein-deer* drag a sledge 50 or 60 miles a day. The traveller tied in it, poises it if necessary.

Fallow-deer fight in parties for their pasture, often for successive days. From 500 to 1000 stags were slain in some ancient hunting-matches.

Male deer only have horns, which, after their sixth year, they shed annually; they weigh from twenty to twenty-five pounds. Park deer are called fallow-deer. Great red deer are less common. They have a leader, and, if necessary, fight in concert. The females expose themselves to save their young. The horns shed by the Wapiti American deer, in the Zoological Gardens, weigh 21 lbs. 5 oz.

The *wild boar* is the parent of the common hog, but smaller, less gluttonous, and living chiefly on vegetables. They are only dangerous when attacked, and then the means of defence are tusks ten inches long.

The hedge-hog is an inoffensive animal, often barbarously treated by the vulgar: they live on roots and insects, in holes in banks, and roots of trees with a mossy bed.

Guinea-pigs, or cavies, are the most prolific of animals, but very harmless and amusing. They feed on herbs, fruits, &c.

Squirrels are the most active of animals, and very harmless, living on nuts and fruit.

The Java squirrel flies from tree to tree, by a membrane stretched like a sail. They are 18 inches long. Squirrels in bad seasons often migrate in northern climates in amazing troops, moving onwards in right lines, like lemmings and rats.

Hares are universal animals, but of various sizes from 7 to 12 lbs. In the arctic circle they are white in winter. Their stratagems to escape danger are numerous and ingenious, but besides man (the enemy of every thing living,) they are the prey of dogs, cats, weasels, eagles, &c. The Tartarian hare is not larger than a rat, and burrows.

The hare is a timid, but very sensible animal; it cries like a child when caught in a snare, and exclaims *rafe* with human distinctness when worried by ferocious dogs and hunters.

Rabbits would increase to a million in 3 years, and rats in 2 years.

Rabbits do not burrow in hot climates. They have centinels to give warning of danger, who enter the holes last.

The great *ant-eater* catches ants by stretching out its tongue, and lying still, and on the ants running on it he draws in his tongue. But it often breaks into ant-hills, and penetrates them with its tongue till satisfied.

Mole-hills are curiously formed by an outer arch impervious to rain, and an internal platform with drains, and covered ways, on which they pair and their young reside. They live on worms and roots, and bury themselves in a few minutes.

The fore-feet of the mole have great muscles, and in burrowing, they perform the functions of the pickaxe and shovel. Their smell and hearing is very acute.

The sloth crawls on its belly and does not advance 100 yards in a day. It is two days in climbing and descending a tree.—The arm and fore-arm, taken together, are nearly twice as long as the leg and thigh; so that when the animal walks on all-fours, it is obliged to trail along on its elbows. The pelvis is so wide, and the cotyloid cavities turn backwards so much, that it cannot bring its knees together, but is obliged to keep the thighs wide apart. The articulation of the hind-feet prevents the animal from having any power of using them. When the leg is vertical, the foot is in a direction nearly similar, standing on its edge, so that the animal cannot place the sole of its foot upon the ground. The toes of the animal are enclosed, quite to the nails, in a stiff skin, which will only allow of their being bent and straightened all together.

The badger is a perfectly harmless animal, but the object of brutal attacks by the lowest of the people. They are about two feet long, and live under-ground, feeding on roots, frogs, and worms, and are inoffensive.

The *Aard-Vark*, or earth pig, is extremely common in Southern Africa. It measures about three feet five inches from the snout to the origin of the tail. It feeds entirely upon ants, like the *pangolins* in Asia, the *myrmecophaga* in America, and the *echidna* in New Holland. Wherever ant-hills abound the aard-vark is found. He makes a deep burrow, and the facility with which he burrows is such, that it is quite impracticable to dig him out, as he can in a few minutes bury himself at a depth far beyond the reach of his pursuers; and his strength is so great as to require the efforts of two or three men to drag him from his hole.

Lemmings are the locusts of Norway, Lapland, &c., as far as the Urals. They form a bridge head and tail, and those which follow pass over the backs of others. They vary in size from the rat to the mouse, and are celebrated for numbers, and their straight line of emigration in tens of thousands, never turning aside, and destroying as they advance, but encamping at times, and always acting with method.

The Uralian lemmings form magazines, and lay up winter stores. The Scandinavian have but one chamber. They migrate in millions, moving under leaders.

The glutton is the size of the badger, and very fierce and voracious, eating from 6 to 13 lbs. of flesh per day. The raccoon, of the same genus, is well known in Jamaica, &c. where, in troops, it devours the maize and fruits, and catches shell-fish.

The spines of the porcupine are from nine to fifteen inches, and perfectly hard quills, which the animal can raise at pleasure, but *not* dart. They roam by night in quest of roots and vegetables, and are inoffensive, their spines protecting them.

The hedge-hog and porcupine have a cutaneous muscle to raise their bristles, as man has one to move his face.

The ichneumon, in Egypt, performs the office of the European cat as a destroyer of rats and reptiles, and devourer of eggs. It is like the cat, but with shorter legs.

The weasel has similar propensities in northern climates. The ferret has the habits of the weasel. The martin is an enemy of cats. The ermine, or stoat, and the sable, are like weasels but longer, and their skins fetch high prices.

The armadillo, when in danger, rolls itself into a ball, and very hard.

Rats follow man, and in most cities are incredibly numerous. Those of London are calculated at millions, and some, in the common sewers, are double the usual size. They move in troops from farm to farm.

The zorilla or yagouare of Tucaman, has the faculty of discharging such a volume of offensive phosphorescent excrement as to blind and burn its assailant, and render it impossible to wear the same clothes again.

Marmots make spacious and convenient habitations of several chambers, some of them several feet in diameter, and they cut and carry hay for their nests.

Bats, in India, are called flying foxes, and measure six feet from tip to tip. Bats have two pectoral teats, and a thumb separated from the fingers. They fly, but have neither feathers nor beak; they are covered with hair, and have teeth. They breed living young, and suckle with teats. Their wings are the drapery of their bodies, except when they stretch them to fly. They fly in the dark, and avoid objects by a sixth sense, independent of sight or hearing.

Many species of bats have a leaf-like appendage to the nose.

Modern classification does not rank *Cetaceous* animals as fishes. They suckle their young, and, therefore, are classed among mammalia. Their heads are large, and they have little or no neck. Their eyes are very small and backward. The tail is horizontal, and they have swimming paws, analogous to the fore-feet of seals. A single stroke with the tail will cut a boat in two; and they move in the sea above a mile in a minute. The stomach consists of four or five successive cavities. They live chiefly on other species of fish. The aorta of whales is thirteen inches in diameter. In general they are black, but those of Spitsbergen are white.

The marine mammiferæ are whales, dolphins, and porpoises, whose feet are converted into fins. Their tail is horizontal, while that of fishes is vertical. They have warm and red blood, and teats to suckle their young. The dolphins are carnivorous.

The powers of spouting water enables whales to expel what they swallow with their food. It passes into the nostrils, and is accumulated near the external cavity of the nose, from which it is expelled by powerful muscles in fountains of considerable heights.

Certain cetacea are herbivorous, as the amantins, or dudongs, which occupy the bottom of the mouths of tropical rivers. They are inoffensive, but their fins extend like legs for creeping and carrying their young. They are often 15 feet long, and nearly allied to the hippopotamus, though it goes on the land.

Whales, seals, morse, and the dugon trichichus, have breasts like a woman, and suckle their young with great affection.

When a male whale was killed, its female companion threw itself on the body in frantic lamentation, and quietly received from the human monsters the same fate.

Seals, morse, and walruses, display great intelligence, and vie with man; and when a manate is caught, his tribe attempt his rescue with generous and courageous sympathy.

Whales are sportive, and often leap out of the water 15 or 20 feet. They, and the narwhal, are remarkable for their tame and playful character.

The balænæ, or common whales, are often sixty feet long and thirty round. Instead of teeth they have whalebone plates, with hairy borders hanging from the upper jaw. This class includes—

The common whale and Iceland whale	..	..	60 feet
Finned whales	..	..	50 „
Norwhals	..	..	21 „
Spermaceti whale	..	..	60 „
Dolphins	..	..	25 „
Porpoises	..	..	6 „
Grampuses	..	..	20 „
Beaked whale	..	..	24 „

The great whale is a very harmless animal, but has neither the habits nor the conformation of fishes.

Whales appear to pass from the Greenland seas to the Pacific, as is proved by harpoons found in them.

The whale whose skeleton was lately shewn at Charing Cross, was 95 feet long and 18 broad, with 22 feet of head. When found dead it weighed 49 tons, and the skeleton was 35 tons. It yielded 4000 gallons of oil. It was estimated to be 90 or 100 years old. The whales generally caught are from 40 to 58 feet, and yield 30 tons of oil. The tail is 4 or 5 feet long, and 20 feet broad, with great power and activity.

There are nineteen species of that half-human inhabitant of the sea called *Seals*. They are more like men even than monkeys, live in social communities, and display great sagacity and affection. The females are specially interesting in their duties to the young; and among some species but one male and one female cohabit, while in others polygamy is practised, but with regular family government.

Seals may be tamed like dogs, and fed with fish. The land, or water, are indifferent to them, and they bask in the sun while they nurse their young. They are often 9 feet long.

Varieties of seals are called sea-lions, sea-bears, sea-cows, sea-horses, and sea-elephants. They are gregarious, very intelligent, sociable, and affectionate. The males have wives and families, and they seem to be, in the sea, the types of man on land. But man, more savage than they, destroys them without compunction for their oil and

tusks, though the fruits of the earth yield more oil than he can consume.

Herds of seals keep sentinels.

Sea-otters kiss each other, and die with grief at the loss of their young.

Many quadrupeds are strictly nocturnal, as the lynx and most beasts of prey. They sleep through the day, and hunt by night.

Lacteals absorb aliment. *Lymphatics* absorb noxious superfluities. The *veins* absorb foreign substances applied to the surfaces of the body.

Bakewell described animals as machines for converting herbage into flesh.

Duffenbach, of Berlin, ingrafted the feathers of black chickens into a white pigeon, and the contrary, feathers of chickens, &c. into rabbits, &c.; bristles of cats into pigeons; the eye-brow of a friend on his own arm; the claw of a pigeon on its rump; and they all took root and grew. He also scalped a pigeon, and transferred a new scalp from the thigh; and he cut off a rabbit's nose, and sewed it on again with success. All this resembles the Talicotian nose, produced in London by Mr. Carpue.

The following is the average length of life of certain species:—

	Years.
Beaver	50
Dog	20
Wolf	20
Fox	14 to 16
Lion	25 to 60
Domestic Cat	15
Squirrel	7
Hare	8
Rabbit	7
Elephant	100
Pigs	25
Rhinoceros	20
Horse	30
Ass	30
Camel	50
Llama	15
Rein-deer	16
Chamois	25
Stag	under 50
Goat	12
Sheep	under 10
Cows	15
Ox	30
Dolphin and Porpoise	30

Mr. Cross, of the Surrey Zoological Gardens, states, from the experience of forty-eight years, that lions, tigers, leopards, jaguars, and hyenas, (in confinement,) upon an average, live twenty-five years; the smaller cats, as the tiger-cat, lynx, ocelot, margay, and serval, sixteen to eighteen years; monkeys and baboons, sixteen to eighteen years; the coatimondi, racoon, beaver, and civet cats, twelve to fourteen years; the antelope, sixteen to eighteen.

The London Zoological Society was formed in 1826. The Society's Menagerie, in the Regent's Park, and their Museum in Leicester Square, are visited by about 40,000 persons, monthly, during the summer. The stock of animals, in 1837, was:—quadrupeds, 297; birds, 637; reptiles, 18; total, 952.

In the Surrey Gardens the animals are superbly lodged under a glass dome, and among them are the finest specimens in Europe, under the experienced direction of Mr. Cross.

	Years.
Hawks	30 to 40
Blackbird	10 to 12
Thrush	8 to 10
Nightingale	15
Wheatear	2
Blackcap	15
Redbreast	10 to 12
Wren	2 to 3
Titlark	5 to 6
Skylark	10 to 30
Chaffinch	20 to 24
Goldfinch	10 to 16
Linnet	14 to 23
Starling	10 to 12
Ravens, crows, and parrots, sometimes exceed	100
Peacock	20
Common Fowl	10
Pheasant and Partridge	15
Pigeon	20
Heron	60
Crane	24
Swan	100
Pelican	40 to 50
Goose	100
Tortoise	100 to 220
Toad	20 to 30
Viper	6 to 7
Crocodile	100
Carp	70 to 150
Bream and Tench	10
Pike	30 to 40
Salmon	16
Cod-fish	14 to 17
Eel	10
Beetle	3
Mantis	10

Eagles attain a great age: one is said to have died at Vienna, aged 104 years; and Pennant mentions one thirty-two years old. Tacitus states the eagle at 500 years!

Bees:—Drone, four months; worker-bee, six months; female bee, four years.

In 1838, a live frog was found near Kilmarnock, at the depth of 120 feet, embedded in coal, in a nest the shape of its own body. From appearances, it must have lain dormant for several centuries. Hundreds of similar cases of toads, have been published.

Menageries are expensive establishments. The expences of Wombwell's collection are £35 per day, or above £12,000 a year. The cost of the animals is very considerable. A fine elephant cost him 1000 guineas; tigers have been sold at £300 each; a panther is worth £100; hyænas, from £30 to £40; zebras, from £150 to £200; a fine ostrich is worth £200. A young Indian one-horned rhinoceros cost Cross £1000; and three giraffes cost the London Zoological Society £700, exclusive of expences. Wombwell gave £75 for a pair of boas.

The Carnivora, in the Menagerie of the London Zoological Society, are now partly fed with horse-flesh, substituted for beef

OF BIRDS (AVES.)

LINNÆUS distinguishes BIRDS into six orders; *Accipitres*, angular projecting beaks; *Picæ*, compressed beaks, with climbing feet; *Ansares*, beaks with skin, and broad at end; *Grallæ*, with three or four toes; *Gallinæ*, convex bill, and arched upper mandible; *Paperes*, conic, and pointed bills.

3800 species of birds have been described. America contains 396, and Europe 395, of which 275 are in Britain.

The Museum at Berlin contains 6000 species of birds, and there are 500 in other collections, besides new discoveries.

In birds, the vertebræ of the neck vary from 9 in the sparrow, to 23 in the swan. Of the back, from 6 in the bull-finch, to 11 in the swan and cassowary. Those in the tail, from 0 in the sparrow, to 9 in the ostrich. They have no lumbar vertebræ.

The pectoral muscle is fixed in birds, and they have three muscles to assist in flying, equal in bulk to all the other muscles. They have also peculiar muscles for perching.

Birds exceed mammiferous quadrupeds in the quantity of their respiration, for they have not only a double circulation, and an ærial respiration, but they respire also through other cavities besides the lungs, the air penetrating through the whole body, and bathing the branches of the aorta or great artery of the body, as well as those of the pulmonary artery.

The song of birds is a movement in succession, equal to a bar of 4 adagio crotchets, performed in 4 seconds. Of singing-birds, the nightingale unites the highest perfection of qualities, the linnet next, then the tit-lark, the sky-lark, and the wood-lark; the goldfinch and the robin excel in lively notes.

Birds have two larynxes at each extremity of the wind-pipe. That next the lungs is the organ of singing. In some there are windings in the windpipe. In July, most singing-birds become silent. Those which sing through the winter are young birds.

Gardner shows, in his notation of the music of birds and animals, that most of the original ideas of the first composers are derived from those natural expressions.

The song of free birds is different and superior to that of the unfortunates kept in confinement—often in such small cages as scarcely to be able to turn.

The voluntary act of emptying the stomach is possessed by some birds, as the pigeon, which has an organ for secreting milk, and it softens the food for its young by previously swallowing it; and afterwards, putting its bill into theirs, returns it into their mouths.

Small birds baffle hawks by flying round and above in great numbers.

The crests of birds are analogous to the horns of ungulata.

Birds which nestle in holes, as woodpeckers, wry-necks, robins, swallows, &c. have eggs of a shining white. Pale green or pale blue characterizes the eggs of the starling, fly-catchers, hedge-sparrows, &c. A green colour in those who lay loosely among grass. The nuthatch, titmouse, and chimney-swallow are party-coloured, with a white ground.

The birds which pass but part of the year in Britain are the cuckoo, grouse, wry-neck, stare, hoopoe, thrush, ring-dove, chatterer, turtle-dove, grosbeaks, buntings, finches, larks, fly-catchers, wagtails, warblers, nightingales, black-caps, willow-wrens, white-ears, white-throats, goat-suckers, herons, curlews, snipes, rails, wild-ducks, &c.

Most birds live half the year in their native and breeding country, and half in other countries. Birds of prey migrate by day, and others chiefly by night. At a degree per hour swallows can pass from England into Africa in 20 hours. The males, in general, precede the females. Migrating birds go in a direct line from north to south, and never deviate in their course from east to west, or west to east. In the arrivals of migrating birds, the males arrive several days before the females. Birds of passage which pass to very distant climes and regions return to the same localities, and often occupy the same nests, though absent for many months, at 3000 miles distant. Their migration can, of course, only be the result of intelligence and habit, in which the older birds direct the young ones from generation to generation. Their flights to and fro are often witnessed in the Mediterranean. Some fly 120 miles an hour, and start when the wind is fair.

The following are the days on which the migrations of swallows, to and from the neighbourhood of Gosport, have been successively observed for 10 years by Burney.

ARRIVAL.		DEPARTURE.
1818,	April 25	September 29
1819,	—— 22	October 1.
1820,	—— 26	——— 13
1821,	—— 15	——— 8
1822,	—— 27	September 28
1823,	—— 23	Not observed
1824,	—— 18	October 18
1825,	—— 13	——— 11
1826,	—— 18	September 27
1827,	—— 13	October 3.

The greatest deviation in the time of their arrival is a fortnight, and in the time of their departure four weeks.

Spring in Norfolk.—The following table is the register of more than sixty years' observations, made by Mr. Marsham.

	Earliest.	Latest.
Thrush sings	Dec. 4	Feb. 13
Nightingale sings	Apr. 7	May 19
Churn Owl sings	Apr. 29	June 26
Cuckoo sings	Apr. 9	May 7
Ring Doves coo	Dec. 27	Mar. 20
Rooks build	Feb. 2	Mar. 14
Young Rooks	Mar 26	Apr. 24
Swallows appear	Mar. 30	Apr. 21
Frogs and toads croak	Feb. 20	May 16
Yellow Butterfly appears	Jan. 14	Apr. 17

Swallows stay in England from 22 to 26 weeks. Other birds from the arctic circle pass their winter with us, and breed there, as the auk, the woodcock, snow-bunting, &c. which pass to Lapland, Greenl

The swan lives 200 years, the crow, parrot, and raven 100, the goose 80, the hen and pigeon 16.

The golden-crested wren is the smallest British bird.

There are 50 species of woodpeckers. The largest native of England is the green, 13 inches long, an enemy of ants.

Sparrows have three broods in a year.

The magpie, the wren, and the long-tailed titmouse, build domed nests.

The Pelicans use a throat-bag, for the purpose of bringing the fish which they catch in the sea to the shore, and then eject them and eat them at their leisure.

In the atrocious practice of pitting cocks, the Battle Royal and Welsh Main demand that every bird should be destroyed!

Rooks live in sagacious polity. They consider for days before they build; and those established resist all encroachments.

20,000 Gannets are taken annually at St. Kilda.

There are 32 species of the falco genus, including most birds of prey, as eagles, kites, hawks, falcons, &c. They are very active, keen-sighted, strong, and long-lived. They subsist on young animals, fish, seals, and other birds. These savage birds used formerly to be tamed, and used for genteel pastime! In the age of Henry III., John, &c. falconry was in such request, that particular falcons were valued and fed highly.

There are 4 species of swallows, or *hyrundo* genus: the chimney swallow *(rustica,)* the house martin *(urbica,)* the sand martin *(riparia,)* and the swift, *(apus.)* They arrive in this order.

There are 50 species of Owls, a bird of night, and very solemn in its appearance, having a ruff which resembles the full wigs worn by judges.

Carrier pigeons are a larger species than the common pigeon. They have a wattle extending half over the bill, and hanging down on both sides as a piece of white flesh, and this is supposed to be connected with their properties as carriers. Their eyes are also surrounded by a similar substance, and importance is attached to its width. They were used by the ancients during sieges, and all eastern nations employ them. In Turkey there are stations from which they pass, and fresh birds are forwarded. They train them to different distances progressively, but their flight is only certain while they have eggs or unfledged young. They rise very high before they start, and travel from 25 to 40 miles an hour. Besides this singular return of pigeons, the swallow, the crow, cats and dogs, have the same occult faculty. By a careful experiment in July, 1830, it appeared that pigeons passed from London to Antwerp, about 210 miles, in 5½ hours, *i. e.* at 38 miles per hour.

Two pigeons flew from London to Liskeard, 220 miles, in six hours.

The Swift moves 4 miles a minute.

The raven lives through the arctic winter.

The pheasant is Asiatic, the fowl and peacock Indian, the turkey American.

A swallow usually flies a mile a minute for 10 hours a day.

It is calculated that the birds of passage that visit the British Islands consume 15 millions of insects per day, whose existence is promoted by our hedge-rows.

The *grosbeak* creates a social nest in a canopy like a parachute, and builds some hundred nests in the rim or eaves. 320 nests, for at least 640 of these interesting birds, were found in one tree. The roof is a thatching with grass.

The *baya*, or Indian grosbeak, remarkable for its pendant nest, is rather larger than a sparrow, with yellow-brown plumage. He builds his nest on the highest tree he can find, especially on the palmyra, or Indian fig, and he prefers that which happens to overhang a well or a rivulet. He makes it of grass, which he weaves like cloth, and shapes like a large bottle, suspending it firmly on the branches, but so as to rock with the wind, and placing it with its entrance downwards to secure it from birds of prey. It usually consists of two or three chambers.

The black ostrich stands 7 feet high. The speed is that of a horse, and they can carry a man. The cassowary is as large, but has a shorter neck. They feed on vegetables.

In Norway, eagles destroy oxen by the following contrivance: they dive into the sea, and then roll themselves in the sand, and afterwards, by flapping their wings, and shaking their feathers in the eyes of an ox, they blind it and overcome it.

Hungary contains the cinereous vulture, the golden eagle, and the ring-tail eagle.

The bird of Paradise is a native of North Guinea, near the Equator. They migrate to Aroo in flights, but will not live in the cruelty of confinement.

A Peruvian condor has spread wings 40 feet, feathers 20 feet, quills 8 inches round.

The male Emus collects the eggs dropt by the female, sits, and hatches them.

On the Malabar coast, a flight of parrots is as destructive as locusts.

Petrils are called by sailors, Mother Carey's Chickens, and are absurdly considered as portentous of disaster.

Flinders saw a stream of sooty *petrils* in Van Dieman's Land, 88 yards deep, 300 broad, and 1½ hour long, as swift as a pigeon, which stream, nine cubic yards for each bird, must have contained 151 millions.

Black swans are found in Van Dieman's Land, in New South Wales, and on the western coast of New Holland. They are generally seen in flocks of eight or nine.

The great peculiarity of structure of the *Penguin*, is its large and excessively distended jugular veins near two inches in diameter. But the abdominal venous sinus of the sea-leopard, or leopardine seal, is 17 inches in diameter.

The duck-billed platypus is said to produce by hatching its eggs within itself, and to have a poisonous spur on its legs.

Walsh describes a species of *woodpecker*

about the size of a thrush, of a light-blue colour, with black marks beside the bill. It entered my room with all the familiarity of an old friend, hopped on the table, and picked up the crumbs and flies. It climbed up the wall by any stick or cord near it. It sometimes began at my foot, and, at one race, ran up my leg, arm, round my neck, down my other arm, and so to the table, and there tapped with its bill.

The biscacho, or Coquimbo owl, is found all over the plains of the Pampas. They live in holes like rabbits, and as soon as the lower limb of the sun reaches the horizon, they are seen issuing in all directions. They sit outside and appear to be moralising, being the most serious-looking of animals, and even the young ones look thoughtful. In the day-time, their holes are guarded by two, who never go from their posts.

Chickens are hatched by the heat of ovens by the natives of Berme, a village in Egypt. They hire themselves over Egypt for the purpose, and undertake to deliver ⅔ds as many chickens as eggs. The ovens contain from 40 to 80,000 eggs, and there are 400 of them in different parts. Each brood occupies 21 days, and they work their ovens for 6 months, producing 100 millions of chickens.

A hen with a human countenance hatched in Poland, was seen by Curier.

A male and female peacock was sold in Athens for 31 guineas of our money, as emblems of Juno. They live a century.

All travellers agree that language cannot convey an idea of the beauty of the plumage of birds in the woods of America.

Audubon describes the wonderful flocks of pigeons which range over North America. He saw 163 flocks in 21 minutes, all passing in one direction, at the rate of a mile per minute, and he estimated each flock to contain a billion of pigeons, and in this way they were passing many days. But what is most extraordinary is their encampment. It is upwards of nine miles in length, and four in breadth; the lines regular and straight; within which there is scarcely a tree, large or small, that is not covered with nests. Persons on going into their camp have great difficulty in hearing each other speak, and every thing appears to be conducted in the most perfect order. They take their turns in sitting, and in feeding their young, and when any are killed upon their nests by savage sportsmen, others supply their place.

The great American *bittern* has the power of emitting a light from its breast equal to the light of a torch.

Humming-birds are peculiar to America. The grouse to Britain, Norway, &c.

The American *mocking-bird* is the prince of all song-birds, and altogether unrivalled in the extent and variety of his powers; and, besides the fulness and melody of his own notes, he has the faculty of imitating the notes of all other birds, from the humming-bird to the eagle. Wilson states, that the ease, elegance, and rapidity of his movements, the animation of his intelligence he displays in listening and laying up his lessons, mark his genius. His voice is full, strong, and musical, and capable of almost every modulation, from the clear mellow tones of the wood-thrush to the savage scream of the bald eagle. In measure and accent he faithfully follows his originals, while in force and sweetness of expression he improves upon them. In his native woods, on a dewy morning, his song rises above every competitor, for the others seem inferior accompaniments. His own notes are bold and full, and varied beyond all limits. They consist of short expressions of two, three, or at most five or six syllables, generally expressed with great emphasis and rapidity, and continued, with undiminished ardour, for half an hour or an hour at a time. While singing, he expands his wings and his tail, glistening with white, keeping time to his own music, and the buoyant gaiety of his action is no less fascinating than his song. He repeats any tune taught him, though it be of considerable length, with great accuracy. He runs over the notes of the canary, and of the red-bird, with such superior execution and effect, that the songsters are silenced. His imitations of the brown thrush he often interrupts by the crowing of cocks; and his exquisite warblings after the blue bird are mingled with the screaming of swallows, or the cackling of hens.

The American yellow-breasted chat scolds an intrusive passenger in a great variety of odd and uncouth monosyllables, difficult to describe, but easily imitated so as to deceive the bird himself. At first are heard short notes, beginning loud and rapid, and becoming lower and slower. Then succeeds something like the barking of young puppies, followed by a variety of gutteral sounds, and ending like the mewing of a cat, but hoarser.

The red-eyed flycatcher has a loud, lively, and energetic song. The notes are, in short emphatic bars of two, three, or four syllables. On listening, it requires but little imagination to fancy you hear the words, *Tom Kelly! whip! Tom Kelly!*

The crested titmouse possesses a remarkable variety in the tones of its voice, at one time not louder than the squeaking of a mouse, and in a moment after whistling aloud and clearly, as if calling a dog.

The red-breasted blue bird has a soft, agreeable, and often-repeated warble, uttered with opening and quivering wings. In his courtship he uses the tenderest expressions, and caresses his mate by sitting close by her, and singing his most endearing warblings. If a rival appears, he attacks him with fury, and having driven him away, returns to pour out a song of triumph.

FISHES. (PISCES.)

Fishes are, by Linnæus, divided into five orders:—Abdominales, Apodes, Cartaligi. nii, Ingulares, and Thoracaci.

possessed materials for describing

6000 species of fish, and there are in all 8000.

Peron and Le Sueur assert, that there is not one fish, or zoophite, however simple in form, the same in the Arctic seas as in the Antarctic, or even in the Southern hemisphere as in the Northern.

Air is as neccssary to fishes as to animals, and they respire in sleep twenty-five times in a minute. The air is extracted from the water by an apparatus called *branchial*, small, but extensive when spread out. They die in water deprived of its air, under ice, or on having their gills tied up.

The gills of fishes are composed of four plates on each side, and communicating with the throat by a single opening for each gill. They receive the water by these holes, and discharge it by a different opening, after appropriating the air. The gills too, have a moveable cover. The gills of the cancer are near the legs.

The air-bladder of fish enables them to rise or sink at pleasure; and this power, and that of the fins and tail, gives the largest speed—a speed many times greater than any ship.

The brain of fish is small, and does not fill the skull. They have no tympanum, and no external ear. They have neither windpipe nor larynx, but breathe by gills. Their nose is not connected with respiration, and they have no urinary bladder.

There are 115 vertebræ in the eel, and 207 in the shark.

Only a few fishes have ribs, there being no respiratory organs to protect in the chest. Their bones are radii.

Fishes have a double circulation, but their respiratory organs (the gills) are only formed to respire by the intervention of water, and their blood only receives the portion of oxygen dissolved or mixed in the water.

Fishes are believed to be of equal specific gravity with water, and occasional inequalities are corrected by their air-bladder. They move by the action of their tails, and not by their fins, which are mere regulators. Fishes are from ½ to 2 degrees warmer than water.

Many fishes are very playful, and display much humour in their frolics.

In general, fish are voracious, and prey on one another. They grow slowly, carp grow but 2 or 3 inches per annum, and live to a great age; some in the lake at Fontainbleau being 2 or 300 years old. Sea-fish grow for 6, 8, or 10 years. Mackarel, turbot, and barbel, are 6 or 7 years old when eaten by men. Whales live many centuries.

Fish are drawn towards a light; they assemble to be fed by the sound of a bell, are fond of music, and of particular instruments.

Many fish feed chiefly on herbs and vegetables, and carp and tench are reared on grains, malt, or boiled seeds.

The eel feeds on worms and snails, and often traverses fields in search of them.

Young eels migrate in May, when about two inches long, in a line often extending for miles, for room and change of water.

The Chinese hatch the spawn of fish in hens' eggs.

All flat fish are comprised in the genus *pleuro nutes:* species of which are the flounder, hollibut, plaice, sole, turbot, dab, &c. They have their eyes on the right side.

The cod-fish, or gadus, which supplies the Catholics with such luxurious repasts on their *fast*-days and in Lent, abounds, in shoals, on the coasts and banks of Newfoundland, Cape Breton, and Nova Scotia. They are from 14 to upwards of 40 lbs.

The cod, according to Leuenhoeck, annually spawns nine millions of eggs; the flounder a million, the mackerel half a million, the herring 10,000, the carp a quarter of a million, the perch more, and the sturgeon six or seven millions. Of the viviparous, the blenny brings forth two or three hundred. The spawn of one genus is mostly devoured by others, and not one egg in a hundred is supposed to be hatched.

Mackerel, &c. pass the winter in the mud or sand in deep water, and emerge in spring. Sprats live in the sand.

Herrings breed in the Arctic ocean, and in April and May pass in immense shoals through the British seas, followed by fishes and birds of prey. The Dogger Bank in the North Sea, 190 miles long, is the favourite resort of these, and of turbot, cod, soles, &c. Other banks in the same sea, from Holland to the Shetland Islands, are also resorts.

Herrings form 3 shoals round the British coasts of 5 or 6 miles long, and 3 or 4 broad, each comprising millions.

Pilchards are so numerous, that 240 millions have been at one time in St. Ives' Bay.

The cod, haddock, whiting, mackarel, and tunny also visit our seas, and generally arrive on the same spot, in the same week of the year. A shoal of haddock has been seen on the Yorkshire coast, 3 miles by 40.

Gold and silver fish live in vases without food, so the pike, and even the salmon has usually an empty stomach, and also the whale. The sturgeon lives on sea plants.

In ponds, heated by the waste water discharged from steam factories, gold and silver fish breed abundantly.

Gold and silver fish, or gold carp, were first brought, about 1728, from China, where they are only the size of an anchovy.

Dolphins are gregarious, and move in shoals of thousands, so do salmon and sharks.

Large seas only afford whales, porpoises, dolphins, sharks, bonitos, and flying-fish.

Sharks, blennies, rat-fish, and eels, are viviparous.

The salmon, salmon-trout, smelt, and shad deposit their eggs in fresh water, and ascend rivers leaping over all obstacles.

The salmon is in the egg 4 months, and the carp 3 weeks.

Salmon like migratory birds return year after year to the same spawning place.

The sea-unicorn is 17 feet, with a horn 17 feet like ivory.

Many fish, as the John Doree, &c. are of a gold colour when alive in the water.

Sharks are often so large as to weigh 3 or 4000 lbs. They live partly on vegetables, but are voracious of every thing, and the terror of tropical seas.

The white shark has swallowed a man whole.

The delphinus, or dolphin genus of fishes, consists of the dolphin, porpoise, grampus, and leucas, or white fish.

The dolphin has a larger and more circumvoluted brain than man, and taken altogether is one of the cleverest of fish; many of them displaying great powers and strong feelings

The flying-fish rises 10 or 12 feet out of the water, and keeps the air 100 yards, when it is obliged to wet its fins by dipping. They are 12 or 15 inches long.

The fishes that fly by their pectoral fins are species of triglia, as the gurnard, the tropical flying-fish, the blennius, &c.

The medusa has long blue filaments, which are so poisonous that no fish of prey dare approach them.

The chædoton rostratus, sparus insidiator, and zeus insidiator, live on insects caught by ejecting water at them. Several species live on crabs.

The jaculator fish of Java, if placed in a circular pond, from the centre of which projects a pole two feet in heighth, and if at the top of this pole are inserted small pieces of wood sharp-pointed, and on each insects placed of the beetle tribe, the fish coming to the surface of the water rests there, and, after steadily fixing its eye on an insect, discharges from its mouth a small quantity of watery fluid, with such force and precision of aim, as to force it off the twig into the water. After this, another performs a similar feat, and is followed by the others, till they have secured all the insects. They frequent the shores and the sides of the sea and rivers in search of food, and when a fly is sitting on plants that grow in shallow water, it swims on to the distance of from four, five, or six feet from them, and then ejects a single drop of water, which never fails to strike the fly.

The salmon grows to 6 feet, the pike from 1 to 6 feet, the carp to 4 feet, the porpoise 5 to 8 feet, and the dolphin 9 to 10.

The coryphæna hipparis follows ships for offal, &c.

Many kinds of sea-fish, kept together in a salt-water pond, live in harmony.

At Coppermine River, fish are so frozen as to break with the blow of a hatchet; but, if others when frozen, are thawed before the fire, they revive.

TESTACEA AND SHELLS.

The Testacea, or Shell fish, have 4500 species, and those without shells 600; of radiata, as star-fish and medusa, there are 1000 species, and of polypus and corals 1500.

Turton enumerates 37 genera of testacea, with hundreds of species, the Helix 269, the Patilla 220, the Venus 154, the Murex 181, the Voluta 144, the Turbo 151, &c.

Mollusca have no skeleton, and the muscles are attached to the skin, which encloses the viscera and nerves. In many, a shell is added to the skin, and, in all, there are circulating, respiring, and digesting systems, with senses of taste and sight.

Aristotle divided Shells into three orders; univalves, of one piece, and bivalves, and turbinated; and the same arrangement is still preserved, except that the order is changed by Linnæus, and the turbinated are called multivalves; and he divides them into three genera of multivalves, fourteen of bivalves, and nineteen of univalves.

Latreille has published another arrangement in 153 genera. The best work on British shells is by Donovan.

In univalves, in some species, the cavity is divided into chambers, with a pipe of communication; the base is the mouth, and opposite is the apex. The convolutions are called whorls. The hinge in bivalves is sometimes furnished with teeth. It is usually joined by a strong ligament. They adhere to rocks by a thread-like substance, called the beard.

Crustacea cast their shells once a year, and after remaining some time in a tender soft state, secretions of carbonate and phosphate of lime renew them. They also renew lost limbs, which after two or three moultings resemble the originals. Their remains, often very perfect, different from modern species, are found in cretaceous rocks, as oolite, lias, chalk, with crabs and lobsters often above the chalk, and in London clay. In general, they are poisonous, and if eaten produce blotches in the face, and cutaneous eruptions. There are four genera, the cancer the oniscus, the monoculus, and phalangium.

Nautili, volutæ, and cypræ, are only perfect in warm climates, and chiefly confined to them. The haliotis gigantea is found at Van Dieman's Land.

Four shell-fish, packed in cotton, and brought from Valparaiso, were, after from 13 to 20 months, revived in full health.

Snails, shut in a box with air, close themselves in their shells, and live in a dormant state for months, or years, and revive in water, at 72°.

The tridacna gigas, the largest of testacea, is a bivalve whose valves are 4 feet long, and the animal enclosed weighs 500 lbs., and the ligament by which it is fixed to rocks requires to be cut with a hatchet.

The shell of a sea-cockle is the circulating medium of Angola and the neighbouring kingdoms. The cockles are caught on the shores of the island Loanda, held by the Portuguese, who make the people tributary.

The snail called *helix formatio* is eaten at Rome by the people during Lent, being fattened purposely! When snails attack fruit, they touch no other till that is gone. Their eyes are at the end of each horn. Lice are found on their bodies, and worms in their intestines.

A shower of crabs fell with heavy rain, in

the summer of 1829, in the yard of the poor-house at Reigate, and were lively, weighing two ounces. Facts of the same kind are very numerous, and such descents are ascribed to ascents by whirlpools, &c.

The bony scale on the back of cuttle-fish is used for tooth-powder and pounce. This fish squirts a black fluid like ink.

The Persian pearl-fishery is carried on at the Bahrin Islands, in the Persian Gulf. The vessels amount to many hundreds, and the pearls weigh from ten to fifty grains.

Oysters differ from muscles in being attached where they grow. They spawn in May, like drops of candle-grease in water, which attach and grow for three years. At Coromandel they are two feet in diameter.

The liquor of the oyster contains innumerable embrios, with transparent shells—120 to the inch; and, also, other animalculæ, as three kinds of worms, &c. They turn over with the tide. The sea-star, men, cockles, and muscles are their enemies.

The *testudo*, or tortoise, is so long-lived, that two are recorded in England who lived 120 and 200 years. They know their friends and display much intelligence. The turtle of this genus is very large, and subject to cruelties to satisfy the whim of epicures.

In the library of Lambeth Palace is the shell of a tortoise, brought there in 1623. It lived till 1730, and was then accidentally killed. Another, in the Palace, at Fulham, procured by Bishop Laud, in 1628, died in 1753. One at Peterborough lived 220 years.

The green sea-turtle is most prolific in the rivers of South America. They go to sea for hundreds of miles. The midas species can run with 6 cwt., or 3 or 4 men.

Shell-fish form a vacuum, so that they adhere to rocks by a force equal to 15 lbs. to the square inch of their contact.

The callichthis silurus inhabits such streams as often dry up, and then crawls across meadows in search of other water.

The migrations of the land crabs from the mountains in Jamaica, and the Bahamas, to the sea, to deposit their spawn, and their return, are most wonderful. They move in 3 troops of millions, in an exact right line, and in the greatest order, subject to the weather, preferring nights, or rainy days.

Our art of sailing is merely an imitation of the nautilus. There are thirty species; some so large that drinking-cups are made of their shells. The fish is independent of the shell. In sailing, it stretches out two of its arms, which hold up a membrane as a sail; and with two other arms and its tail, rows and steers. The prodigious number and size of those in a fossil state prove that they were at one period more important than they have been since.

The monoculus, or crab genus, has fifty species, distinguished into seven sections, as they have one or two eyes, or one or more shells.

Lobsters and crabs change their shells annually. For three or four days they are naked, defenceless, and preyed upon. Their limbs shrink before drawn out, and they grow only in the soft state. They lose their limbs in fighting, "or by thunder-claps, or reports of cannon," but they grow again. They leave seas where cannon are often fired, and swim with immense rapidity.

Large muscles, the uneo margaritifera, produce pearls, for which Britain had Roman fame.

REPTILES, OR AMPHIBIA.

There are full 1500 species of Reptiles and Frogs.

The organs of circulation of reptiles are simple, and only a portion of the blood brought back by the veins passes through the organs of respiration.—Their quantity of respiration, and all the other qualities that depend on it vary.

Amphibia are cold-blooded, and their lungs and heart are differently formed from warm-blooded animals. Their lungs are like bladders, or membranes, and the heart has only one ventricle, with a vein to convey it in, and an artery to carry it out. Their limbs and tail destroyed, grow again. They are torpid in winter, freeze with and in water, and revive when it melts.

Some amphibia have branchæ like fishes, and lungs like land animals. The larvæ of frogs and some other species are thus formed.

Amphibia are divided into two orders, *Reptiles* and *Serpentes;* and there are four genera of reptiles, testudo, draco, lacerta, and rana; and nine of serpents, crotalus, boa, coluber, angeris, amphisbœna, cæcelia, achrocordus, hydrus, and langaya.

Reptiles become torpid when the temperature is below 40°. Snails, mollusca, and land testacea do the same. In hot and equal climates, as between the tropics, hybernation is unknown.

There are ten species of scorpions. Their bite is poisonous in the tropics, but the European species kill only small animals. In France a dog and some pigeons died by the stings in their tails, which they curve for offence or defence.

There are 81 species of *lacerta* or lizard, of which the crocodile, the alligator, and guana are the chief. Those in England are very inoffensive timid creatures, and one species is the water-newt, three or four inches long.

Twelve species of crocodiles have been distinguished, four of which are called alligators, and two gavials. Those of the Nile are the largest, but they are now very uncommon; at least in Lower Egypt, where a crocodile would be regarded as a great curiosity. Their form is that of a lizard, sometimes thirty feet long, and nine or ten feet round. The body is covered with scales, hard enough to turn a musket-ball; with a mouth several feet long, filled with teeth like a saw. They pursue their prey with agility, but cannot turn, and therefore are easily escaped; but whatever is once caught is held fast, and if large, drowned. They roar like a bull. The females lay from 30 to 100 eggs in a season, but they are de-

stroyed by the ichneumon; and some species of the tortoise destroy their young. They are so tenacious of life, that it is very difficult to kill them. If well fed, they become tame; and Labat, an African traveller, asserts that they are seen in villages without dread, and even played with by children; their usual ferocity being ascribed solely to hunger. The excrements are vomited up, and the crocodile is obliged to come on shore to ease himself.

The cranium of a large crocodile will only admit the thumb.

There are 36 species of the *rana* or frog genus, including toads, the whole being innoxious, while the common toad is curious from its longevity when enclosed in hollows of trees and stones, and the Surinam toad from its producing its young from cells in its back. The American bull-frog, 18 inches long, is so called from the frightful noise it makes in the woods.

A toad was found at Organ, in France, in a well which had been covered up for 150 years. It was torpid, but revived on being exposed. Many well-authenticated cases are recorded of toads found alive in old stones, and in old trees, where they must have lived for many centuries.

On the curious question, whether toads live, as reported, in holes in stones, Dr. Buckland, of Oxford, has published an account of some rather cruel experiments.

On the 26th of November, 1825, he placed one live toad in each of twenty-four cells, twelve in coarse, and twelve in compact silecious limestone, with a double cover of glass and slate placed over each of them, and cemented down by the luting of clay. The weight of each toad, in grains, was ascertained, and the large and small ones were distributed in equal proportion between the limestone and the sandstone cells. These blocks of stone were then buried together beneath three feet of earth, and remained unopened until the 10th of December, 1826. Every toad in the smaller cells of the compact sandstone was dead, and the bodies of most of them so much decayed, that they must have been dead some months. The greater number of those in the larger cells of porous limestone were alive, No. 1, whose weight when immured was 924 grains, now weighed only 698 grains. No. 5, whose weight when immured was 1185 grains, now weighed 1265 grains. The glass cover over this cell was slightly cracked, so that minute insects might have entered; none, however, were discovered in this cell; but in another cell whose glass was broken, and the animal within it dead, there was a large assemblage of minute insects, and a similar assemblage also on the outside of the glass of a third cell. In No. 9, a toad which weighed 988 grains, had increased to 1116 grains, and the glass cover over it was entire. No. 11, had decreased from 936 grains to 652. Before the expiration of a second year, all the large ones also were dead; these were examined several times during the second year through the glass covers of the cells, but without removing them to admit air; they appeared always awake with their eyes open, and never in a state of torpor, their meagreness increasing at each interval in which they were examined, until at length they were found dead; those two also which had gained an accession of weight at the end of the first year, and were then carefully closed up again, were emaciated and dead before the expiration of the second year. At the same time that these toads were enclosed in stone, *four other toads* of middling size were enclosed in three holes cut on the North side of the trunk of an apple-tree; two being placed in the largest cell, and each of the others in a single cell; the cells were nearly circular, about five inches deep and three inches in diameter; they were carefully closed up with a plug of wood so as to exclude access of insects, and apparently were air-tight; when examined at the end of a year, every one of the toads was dead and their bodies decayed. And besides the toads enclosed in stone and in wood, *four others* were placed each in a small basin of plaister of Paris, four inches deep and five inches in diameter, having a cover of the same material carefully luted round with clay; these were buried at the same time, and in the same place with the blocks of stone, and on being examined at the same time with them in December, 1826, two of the toads were dead, the other two alive.

Dr. Townson records a series of observations which he made on tame frogs, and also on some toads; these were directed chiefly to the very absorbent power of the skin of these reptiles, and show that they take in and reject liquids, through their skin alone, by a rapid process of absorption and evaporation, a frog absorbing sometimes in half an hour, as much as half its own weight, and in a few hours, the whole of its own weight of water, and nearly as rapidly giving it off when placed in any position that is warm and removed from moisture. Dr. T. contends that as the frog tribe never drink water, this fluid must be supplied by means of absorption through the skin. Both frogs and toads have a large bladder, which is often found full of water: "whatever this fluid may be, (he says,) it is as pure as distilled water and equally tasteless; this I assert, as well of that of the toad which I have often tasted, as that of frogs." Townson found both frogs and toads perfectly harmless and innoxious.

The Teredo Navalis, at Portpatrick, is 2½ feet long; and this, and the small Limnoriæ terebrans, destroy all timber in contact with sea-water. They infest only certain coasts, but ships convey them.

In snakes the vertebræ are from 49 to 300.

Serpents mostly swallow their food entire. The heart possesses two auricles and one ventricle, and they all breathe. Hogs and goats kill and devour them. They live on land, or in water, either salt or fresh.

The boa constrictor is from 20 to 36 feet long, and capable of swallowing deer, calves, or men whole, first crushing the bones by

the strength of its folds. It usually catches its prey by hanging from the branch of a tree near the places where animals go for water, and its destructive powers are pressure, for it has no poison fangs.

In 1813, a boa constrictor was killed in the Isle of France, 14 feet 6 inches long: in his stomach were found several animals, as monkies, &c. half-digested.

The rattle-snake is from 5 to 8 feet long, but does not attack, and gives warning by rattling its tail.

The coluber is from 30 to 40 feet.

Pliny, and others, relate that Attilius, a Roman general, killed a serpent 120 feet long, near Utica.

Eleven genera of serpents have no poison fangs, and 19 have, but, compared with the others, these are very few in number. The chief of them are the rattle-snake, the crotalus of Carolina, one genus in Madagascar, another in Martinique, the naja of India and South America, the black adder of Sweden, and the viper, or adder, in England.

Good intelligence should distinguish between the perfectly harmless *snake* of England, and the venomous adder. The snake is oviparous, from two to five feet in length, of a greenish brown, with mottled longitudinal stripes, and ringed belly, of dull yellow and blue. The venomous *adder*, or *viper*, is viviparous, from two to three feet, with diamond spots in a bold pattern, and the belly dirty yellow. Its young, for protection, run down the throat of the parent. The slow-worm, or blind-worm, eleven or twelve inches, is harmless and viviparous.

The progressive motion of serpents is effected by raising the body into arches, and fixing their hinder scales into the ground, and in this way they move backward and backward, the ribs concurring with an active motion. This mode of progressing, so different to other animals, led the ancients to regard serpents with veneration, and to their consecration, as allied to the Deity!

The great viper was accidentally carried a few years ago in a ship to Martinique, and is now most mischievous.

The whip-snake darts on animals from trees, apparently, for mere mischief.

Viviparous serpents are venomous, and most of the oviparous not venomous, and with no fangs. The green and yellow viper is perfectly harmless. The eye is surrounded by yellow scales, and they are pleased at being played with.

The rattle-snake may be frozen brittle, and thawed into life. Their bite is not fatal, and may be cured by volatile alkali.

Venomous snakes are slow in doing mischief. The cobra di capello, the toy of Indian jugglers, retains its fangs, but never uses them, except to resent injuries; and then; opening its crest, and hissing violently, it darts on its victim, who has notice to escape.

Pterodactylli were flying reptiles, or swimming animals.

Worms increase as moles are destroyed, mice as owls are shot, and rats, mice, &c. as foxes are diminished.

A leech of 3 drachms takes 3½ of blood, and as much more escapes after. Those of smaller size in less proportion; so that 24 large leeches take 17 ounces, and 24 small ones but 3.

Tadpoles live on the flesh of a dead fish, so as to leave a perfect skeleton in two or three days.

A Manilla reptile changes its colours as distinctly as the cameleon, pea-green to carmelite, bluish green, brown streak, &c. by the flexture and variation of its skin.

Worms, so indefinite in number, and so universal, are most useful in consuming soft refuse matters, in opening the ground, and forming canals of rain to roots, &c., and as food for birds and fish.

Earthworms are said to restore themselves after being cut with a spade. A snail's head and horns grow again in six months. An eye of a water-newt is re-placed in ten months.

The whole order mollusca of vermes are all more or less phosphorescent.

White ascribes the poverty of oft-flooded lands to the destruction of the earth-worms, which he considers a link in fructification.

A sea-worm 60 feet long has been discovered on the Sussex coast, twisted as in a knot, and harmless.

A sea-snake was cast ashore in Orkney, which was fifty-five feet long, and the circumference equal to an Orkney pony.

INSECTS.

Swammerdam printed his great work on Insects, in 1669. He divided insects into four classes, as spiders, &c. which include the modern classes crustacea, myriapoda, arachnoida, and acari. His second class consisted of those who appear perfect on leaving the egg, and have no wings till they shed their skin; and it includes the orthoptera, dermaptera, dicteroptera, hemiptera, and some of the neuroptera. In his third class he includes those hatched, as caterpillars, which change into a chrysalis, and remain so till perfect; it includes the coleoptera and aptera. His fourth class includes those who, on attaining their pupa state, retain their skin, as the hymenoptera and diptera.

Ray's work on insects was published in 1712. He adopted two divisions, those which undergo no change, and those which pass through the larva state.

Valasnieri, in 1730, distributed insects into four groupes. 1. Those who live on plants. 2. Those who live in water. 3. Those who live among stones. 4. Those who eat animal remains.

There are 1000 species of the genus *Musca*, fly.

Great Britain has from 8000 to 10,000 species of insects and arachnoidæ, of which 2000 are caterpillars.

All countries have their peculiar insects. Those of China, &c. differ from those of Europe and Africa. Those on the east and west side of the Andes are different.

100,000 species of insects are in collections in Europe.

Kirby reckons 6 insects to every one of our 1500 flowering plants.

The apterous and winged insects are believed to have 550,000 species.

Insects are divided by modern entomologists into 680 genera, and every genus into many species. The study of each genus, its habits, economy, and wonderful ingenuity, according to its powers and the sphere of its existence, has afforded employment for lives.

In 1780, Drury formed a museum of 11,000 species of insects, giving sixpence for all new ones that might be brought him. Donovan's valuable work on British Insects extends to eighteen volumes. P. Martin published an account of 500 species of *coleopterous* insects found in England. Francilec collected 2000 species of the genus Scarabæus. Jones, in 1794, announced a history of the genus *Papilio*, in which he professed to describe 1400 species.

Leach divides insects into 15 orders.

Insects appear as eggs batched as a caterpillar or larva, which changes into a motionless chrysalis or nympha, the covering of which bursting, a butterfly evolves with wings, long-jointed legs, and two antennæ. Some have jaws, others no jaws: some have no wings, and others have four wings variously marked, and one order two wings.

Insects have lymph instead of blood, and no bones, but hard coverings to which the muscles are attached. They have no vertebræ. They do not breathe through the mouth or nostrils, but have air-vessels along their sides, called *spiracula*, and connected with other vessels called *bronchiæ*. They have the organs of sense, and make all the discriminations which accord with their physical powers and wants. They are oviparous, but scorpions and aphides are viviparous. The male is always smaller and more coloured than the female, who alone has stings, but males have horns.

Genuine insects have 6 legs, a distinct head with 2 antennæ, and pores for respiration, connected with tracheæ in the sides. They are produced by eggs, and many pass through three metamorphoses after the egg state. The egg produces the larva, grub, or caterpillar, with 16 feet, 2 jaws, and 12 small eyes; this passes to the pupa chrysalis, and is then changed into the perfect insect, with 6 legs, and a proboscis, with eyes full of lenses.

All insects proper perform respiration by two air-pipes, or tracheæ, which run parallel through the body, and send off branches, and they inspire and expire by apertures in their sides. Their nervous system is two cords, which form ganglions. Their heads have two projecting antennæ, and they have 6 feet. They commence as larvæ, or worms, then change to chrysals or pupæ, and complete their being in various forms. Microscopic insects are generally in the larva state, and books and systems treat chiefly of the imago, or perfected insect.

Mr. Cross, by long-continued galvanic action, has produced in numerous instances, and under various circumstances, crawling insects. It appears also, that if the purest water is exposed to a voltaic current, it produces numerous animalculæ; whether it excites invisible germs, or whether it organizes matter, are questions for faith and discussion. Mr. C. has made an apparatus for sale, by means of which, any one may repeat his experiments in the production both of crystals and insects. They are of the mite family, at first with 6 legs, and then with 8, alike from every substance. They crawl in the fluid and out of it, but on falling in again are drowned.

Insects lay from two eggs to many millions of eggs per annum.

Dr. Dwight published a case of an egg producing an insect 80 years after it must have been laid. He thinks the power of vivification may endure an indefinite period, and mentions that mustard-seed, buried 200 years, grew and flourished. He ascribes to this the periodical intervals of insects.

Insects have long memories and reason in all they do. They assist each other in labour, and regulate their labour by the end in view. They make intelligent communications to one another. In short, they do whatever their wants, habits, or power render expedient. In proportion, the stag-beetle is stronger than the elephant, and the cock-roach than the horse. Fleas exhibit great strength, and docility, and they leap as high as St. Paul's in proportion to a man.

The change in the internal formation of butterflies from caterpillars is surprising. It was all stomach, now a mere thread, and the muscles, &c. are totally different.

The nut-maggot passes some months in the earth as a crysalis, and emerges a very elegant beetle, with 6 feet, ebony beak, wings, wing-cases, &c. Locusts, cock-roaches, bugs, spiders, &c. eat in the pupa state.

The ear-wig hatches and nurses its young with great affection.

We have in England 1670 species of the diptera, or fly genus.

There are 292 species of the bee or apis genus, and 111 in England: among solitary bees, the following deserve notice:

The *rose-cutter*, separates circular pieces from leaves with precision, and digging a hole 6 or 8 inches deep, in the ground, the bee rolls up the leaf, and depositing it in the hole, lodges and secures an egg in it with food for larvæ when hatched; and often several, but all separated, and very perfect; and the bee then resides in the upper part, to protect her brood.

The *upholsterer*, makes a hole enlarged at the bottom, and lines the whole with red poppy-leaves, lays her eggs, supplies them with food, &c. separately, then turns down the lining to cover them, and closing the hole leaves them to mature.

The *wood-piercer*, makes a perpendicular hole with vast labour in a decaying tree in the sun-shine, a foot deep. Then deposits her eggs and food, and separates each by a

dwarf wall made of saw-dust and gluten, each higher than the other, and the last closing the hole; and she then makes another hole horizontally, to enable them to escape as they successively mature.

The *mason bee*, constructs a nest on the side of a sunny wall—makes up sand pellats with gluten, and by perservering industry fixes and finishes a cell, in which it lays an egg and provisions. It then forms others beside it, and covers in the whole, the structure being as firm as the stone.

Wasps and *humble-bees* make cavities in banks. They line them with wax, and make innumerable cells for their eggs in perfect communities, working together and forming lines by the removal of whatever incommodes them.

The *Honey-bee* is well known, and deservedly respected for the use which man makes of their industry, and too often by the wholesale *murder* of the ingenious creatures whom he robs. But this most cruel practice is now even from selfish motives abated. The queen is the mother of the whole hive, and her eggs become males, females, and workers or neuters, which last make the combs and cells, and collect the honey. The Queen produces some thousands of workers, and then males, which the workers kill at the end of the summer. The workers attend the queen with anxious respect. If she die, they raise a new one by various arts from a working worm. Two queens cannot live in the same hive, and one is destroyed.

They have four wings and six legs. The body is covered with hair, and each hair is like a plant in miniature. The proboscis is employed in collecting honey, by licking it from the flower, and conveying it to the stomach, whence it is disgorged into the cells. The wax is formed from the honey. The females and workers have a sting, but the males or drones none. It is double and provided with barbs, which the animal depresses and draws out the sting unless suddenly driven away. The sting emits a poison into the wound.

In proportionate size the queen bee is 8½, the male 7, and the workers 6. A queen will lay 200 eggs daily for 50 or 60 days, and the eggs are hatched in 3 days. The workers are 5 days in the worm state, and in 20 days they become bees. The males are 6 or 7 days in the worm state, and 24 days in becoming perfect bees. A queen is 5 days in the worm state, and in 16 days is perfect. When eggs are converted into queens, the old queen destroys them, or if there are two young queens they fight till one has killed the other. One author asserts that a single queen has produced 100,000 bees in a season. Every thing depends on the workers; they collect the honey, make wax, and build the combs, they supply the worms with food, and protect the entrance of the hive; every separate business being performed by classes.

There are about 9000 cells in a comb of a foot square; their first purpose is as nurseries for the young, and they are then cleaned and filled with honey: 5000 bees weigh a pound, 20 or 30 pounds of honey are generally got from a hive, sometimes 80 or 100 lbs. and even more. Formerly, it was an inhuman practice to suffocate and destroy the bees, but good managers have for many years preserved them and fed them during the winter, by which plan five hives, at 1*l.* each, have in 10 years yielded a profit of 1280*l.* To destroy the swarm for the sake of the honey, is like cutting down fruit-trees for the sake of the fruit.

Nutt's triple hives are the best and simplest mode of preserving bees and securing large stocks of honey. A hive which, in the old barbarous system, yields 100 lbs. of honey, has by Nutt's hives yielded 296 lbs. with swarm preserved for another season.

Huish says, that 20*s.* laid out in a swarm of bees, realizes 60*l.* in 5 years, with the 1 increased to 10.

When bees leave a hive, all the individuals first reconnoitre the new situation in small parties.

A swarm of bees contains from 10,000 to 20,000 in a natural state, and from 30 to 40,000 in a hive.

All the experiments on bees prove, that love for their queen and her progeny is the sole stimulus to their persevering industry. Their joy, grief, and other passions are distinguished in the tones of their humming, which to them are articulate sounds. It is the same with other insects, and with all animals, with various vocabularies.

The hexagonal cells of bees have angles of 109° 26′ and 70° 32′, being the least matter with the largest size in the space.

When two or three distinct hives are united in autumn, they are found to consume together scarcely more honey during the winter than each of them would have consumed singly, if left separate. Sometimes a hive becomes idle, and then makes war on an industrious hive, kills them, and carries off their stock to their own hive.

336 bees weigh an ounce, and 2160 fill a pint measure.

M. Espaignes, of Bordeaux, asserts that working-bees are all males.

The smoke of the dried puff ball (*fungus maximus*) stupifies bees without killing them, and enables the keeper to dispose of them in hives in dark dry rooms for the winter. No true bee-master kills a bee.

In the woods of Brazil is frequently found, hanging from branches, the nest of a species of bee, formed of clay, and about two feet in diameter. Some species of wasp construct hanging-nests. No honey-bees were found in Australasia.

The Wasp's nest is equally wonderful with the bee-hive, and forms a regular city, fortified against encroachments, and containing 15 or 16,000 cells.

Several species of wasps produce galls in oaks, roses, figs, &c.

Every species of spider produces its own kind of web, each in accordance with the size and structure of the animal.

The nests of ants are managed by the

neuters, and usually established in mole-hills, or among the roots of trees. There are eighteen species, and they are remarkably intelligent, ingenious, and industrious. Nests often fight like men, and kill vast numbers of each other. They are carnivorous, though they form magazines of seed. An ant's nest consists of males and of females, who have wings; and also of neuters. The females enjoy the same pre-eminence as among bees; but the manners of ants are more varied, and system, object, and end, mark all their varied reasonings and labours. They have long and tenacious memories, know each other, and distinguish any stranger. They carry on systematic wars, and practice all the arts of attack and defence. Man himself is not more savage in war: but they are citizen soldiers, and not hired and trained for butchery and murder. They also practice slavery, making slaves of those they overcome. They keep aphides as men keep cows.

The *Termes fatale*, or white ant, builds pyramidical structures 10 or 12 feet high, divided into a vast variety of apartments, and so strong as to permit 4 men to stand on them. The community is well governed: they in discipline exceed all other insects.

Ants in tropical countries are infinitely more numerous than in northern latitudes, and sometimes measure an inch or an inch and a half. They raise mounds of an elliptical figure to the height of three or four feet, and are so numerous that they frequently extend over the plains as far as the eye can reach. They abound especially in districts which produce sour grass. The cones become so hard, that they support three or four men, and even a loaded waggon. Internally they are of a spongy structure, and completely saturated with oil.

In Brazil, ants are almost masters of the country, and in Africa not less formidable.

M. Hanhert saw a regular engagement between two species of ants, in which they drew up in lines of battle, with reserves, &c. and fought for four hours, taking prisoners, and removing the wounded.

The ant-hills of our fields are full of cells and passages, curiously formed with twigs and weeds cemented by their own gluten. They disfigure a field, but do not diminish, and rather increase its productiveness for grazing; and in grazing-districts they abound, and are seldom disturbed. They present a larger surface to the air, and increase the quantity of grass and animal food, while they fertilize the soil.

The genus Acarides includes mites and parasites, which live on the skins of animals, and attach themselves to flies, beetles, &c. as annoying vermin. There are 20 genera of them, and they lay so many eggs, that in numbers they equal all other living things.

The species of louse which runs on the bodies and garments of men, is not the same as that which inhabits the head.

The flea, grasshopper, and locust, jump 200 times their own length, equal to a quarter of a mile for a man.

Gardiner, Kirby, and Spence assert that the motions of a flea on a night-cap have been discerned like the clack of pattens. The chirp of the cricket is produced by rubbing the legs together.

Fleas are so numerous on the North-West coast of America, as to master, and often oblige the Indians to change their residence.

The insect which eats round holes in furniture is the *dermestes domesticus;* and the species *lardarius* eat the leather off books and any animal substance.

The change from the larvæ to the roaming fly, (in the horse-stinger) is effected in a few minutes. They crawl from the water to a dry place, the back divides, and the dragon-fly escapes, commencing at once its war on butterflies and other harmless insects.

Arachnides, or spiders, are now arranged as a distinct class, being neither insects nor crabs. Some have a circulating system, some have branchial cells, others tracheæ, and some have antennæ. There are 67 genera. Their webs are a sort of extended nervous system, so contrived as to give instant warning of prey or danger. The prejudice against their forms, and the intrusion of their webs, deprives them of the sympathy which their ingenuity and beautiful colouring might excite, and being true carnivora, as they shew no mercy to their prey, so they meet with none from man. They live long without food, and have been kept for five or six years. They even devour one another. They cast their skins, and renew their limbs.

In experiments to obtain their threads to use as silk, 4000 were collected, but they soon destroyed each other. Again, it required twelve spiders to produce the quantity of one silk-worm, whose cocoons weigh 3 or 4 grains, while a good spider produced but half a grain. So that a pound of silk produced by 2300 worms, would require 27,600 spiders, and all females. But some, in Java, make webs which require a knife to cut them.

The paps whence spiders' threads proceed have 1000 holes, so that each thread is the union of 4000. Some are so fine, that 4 millions of them would not be equal to human hair. They dart their threads, and float on them to distant points. When insulated over water, they dart their threads to leeward, and when attached, fix the near end and pass as on a bridge. In many other respects they exhibit perfect reasoning powers, and their various webs are surprising structures. In the West Indies they are so large as to combat with smaller birds, and they lie in wait, or attack them by night, and overcome them by a poisonous wound. Some of the females produce nearly 2000 eggs. The habits of the whole tribe abound in curious traits and varied ingenuity.

Gossamer consists of the fine threads of the flying spider covered with dew.

The ascent of gossamer takes place only in serene, bright weather, and is invariably preceded by gossamer on the ground. Two minute spiders produce gossamer. When

impelled by the desire of traversing the air, they climb to the summits of various objects, and thence emit the viscous threads in such a manner as that it may be drawn out to a great length and fineness by the ascending current; when sufficiently acted upon, they quit hold of the objects on which they stand, and commence their flight.

The *Gryllus migratorius*, or Asiatic grasshopper, or locust, often darkens the air by its multitudes, and causes sudden famine in large districts, and contagious effluvia and pestilence from the multitudes of them which perish. Areas, from 40 to 50 miles square, are often completely covered with them in warm climates, and often visit districts in North America. Their larvæ are equally voracious and destructive, travelling in straight lines, and leaving neither grass nor any vegetation.

Capt. Beaufort saw near Smyrna, in 1811, a cloud of locusts 40 miles long and 300 yards deep, containing at least 169 billions.

There are 500 species of the parisaical flies called ichneumon. They deposit their eggs in other insects or animals, and there the larva are hatched and find nourishment.

A single female house-fly produces, in one season, 20,080,320 eggs!—*Hader*.

There are 72 species of aphis, from a line long to the size of a fly. They are the blight of vegetation. They are hermaphrodites for the most part, and oviparous. Their excretions are honey, and they are the food of bees and other insects. But they puncture and curl leaves, and destroy wherever they harbour. Earwigs and birds also destroy them, and ichneumon flies make their bodies depositaries for their eggs.

In five generations, one aphis may produce about 5000 millions, and there are 20 generations in a year.

Ephemera are a genus of short-lived insects, which live in their perfect state some 2 or 3 days, some a night, and some species not above an hour. As larvæ and chrysales, they live for 2 or 3 years in water. But in their final form they propagate and soon die, the female in a short time laying some hundred eggs on water.

The louse lays 60 eggs in six days, which are hatched in other six days.

Of Centipedes, or Scolopendra, there are 19 species, some very large, with two legs for every division of the body, seldom 100.

There are 60 species of the dragon-fly, all very ravenous in regard to smaller insects.

The gad-fly deposits its eggs in the bodies of horses, cattle, sheep, &c.

The Peruvian fulgora, or lantern-fly, is above three inches long. The head, or lantern, is half its length and of a straw-colour, and the light splendid. There is also smaller species in India.

In Mexico and South America, fire-flies are very common, which shine by so strong a phosphoric light that a person may read by the light of three of them. The largest species have a luminous patch under the belly, and one on each side of the head. Another species has the light under its wings. When the fly is dead, the light continues, and may be transferred.

There are several hundred species of the Scarabæus, or beetle genus. The hercules species is 5 or 6 inches long, and beautiful.

There are no grounds for the terror inspired by ear-wigs. No medical case is recorded of mischief from them.

There are 6 or 7 generations of gnats in a summer, and each lays 250 eggs.

Bees, beetles, dragon-flies, gnats, spiders, &c. have minute *acari* on their bodies.

The gall-fly forms the gall-nuts on trees and plants by its eggs and young; and the gad-fly does the same in the skins of cattle.

There exists, in Livonia, an insect called the *Furia Infernalis*, so small that it is very difficult to distinguish by the naked eye; yet its sting produces a swelling. And, during the hay-harvest, other insects, named *Meggar*, occasion great injury to men and beasts. They are of the size of a grain of sand, and at sunset they appear in great numbers, pierce the strongest linen, and cause itching and pustules. Cattle, which breathe them, are attacked with swellings in the throat, which destroy them.

The water-beetle, which lives on the spawn of fish, is said to convey it from one pond to another.

Cock-chafers, so cruelly abused by untaught children, are such pets of nature, that they are six years in the grub state advancing to maturity. The paste of a dead cockroach is used, in Africa, as a cure for a locked-jaw.—*Owen*.

The musical grasshopper, called the katy-did, and she-did, fills the American woods with its notes.

The order *Parasita* includes the louse species, which are so numerous that every species of bird, and, it is believed, every animal, has its own particular kind, and the same species never was found on two distinct species of animals.

The speckled caterpillar, which produces the magpie moth, lives through winter on currant and gooseberry-trees.

Many spiders, moths, and beetles, counterfeit death when in danger, and no torture will make them show signs of life while the danger continues.

A moth has been caught at Arracan, which measures, from the tip of one wing to the tip of the other, ten inches. Both wings were beautifully variegated with the brightest colours. This is the largest moth upon record, exceeding in dimensions the largest in the British Museum, which measures about nine inches from tip to tip.

Lyonnet, in his work on the *Phalena Cossus*, or willow caterpillar, states that the number of its muscles are 4041.

A modern traveller asserts, that the stories about the tarantula are errors.

Canadian timber has introduced many new insects. So with some East and West India produce.

The *Mantis*, from its odd motions, has created much attention. They stretch out their fore-legs, and sit up on their hind-

ones, with the fore-ones crossed on their breasts, as in acts of devotion. They are, in India, trained to fight like game-cocks, to please biped brutes.

Every pound of cochineal contains 70,000 insects *boiled to death*, and from 6 to 700 thousand pounds are annually brought to Europe, for scarlet and crimson dyes.

Cochineal insects have lately been sent to old Spain, and are thriving on the prickly pear of that country. They have also been introduced on the island of Malta.

The wings of insects afford an immense variety of interesting and beautiful objects. Some are covered with scales, as in the butterfly tribe. Some are adorned with fringes of feathers, and the ribs or veins are also feathered, as in many of the gnat family, and even these scales and feathers are ribbed and fluted in a variety of ways. The earwig is not generally known to have wings, from their being folded up on the back into so small a compass. In size, wings differ as much as in every other particular, some are so minute as to be scarcely perceptible, and others are several inches in length. The elytra, or wing-cases, of many insects are beautifully transparent objects, such as those of the boat-fly, the grasshopper tribe, and many of the minute cicadæ.

The greater part of the head of most flies is taken up by two protuberances, which on a minute examination with a common magnifier seem to be reticulated, or similar to net-work. These are the animal's eyes, and consist of an immense number of convex lenses. In the libellula, or dragon-fly, there have been counted upwards of 25,000 of a hexagonal figure and a brilliant polish. The eyes of crabs and lobsters, and all that family, consist of square lenses.

Leuwenhoek reckoned 17,000 divisions in the cornea of a butterfly, each of which he thought possessed a separate crystalline lens. Spiders, &c. are equally provided for.

Few insects live more than a year in their perfect state, but often much longer in their larva state.

The antennæ are important organs of insects, equal to the hands of man. By them the bee works in darkness.

The light of glow-worms arises in the two last rings of the abdomen, and only when they are in motion. In water, they illumine it,—their remains are phosphorescent. The emission of light is esteemed a vital action.

The may-fly is a transformation from a very small grub, which, with perfect rationality, makes itself an enclosure, and buoys it on water.

The ant-lion, like a wood-louse, makes a funnel in sand, and conceals itself at the bottom, till an ant falls in, which it overpowers, and the formation of the funnels, &c. &c. display foresight and rationality.

The sexton-beetle, with copper-coloured bands, performs the office of burying dead animals, by undermining their bodies and then covering them with earth. They then use the bodies as receptacles for their young. In 50 days, Gleditsh saw four beetles bury 4 dead frogs, 3 birds, 2 fishes, 1 mole, 2 grasshoppers, &c.; and a single beetle buried a mole in 2 days.

Gnats dance in regular positions, which have been compared to those in a quadrille.

ZOOPHYTES AND INFUSORIA.

Though ranged under one head, yet Zoophytes are the lowest kind of animation, and Infusoria, often the highest in activity, and apparent intelligence. Our knowledge of both is recent. Two centuries ago, naturalists did not ascribe sensation to the beings called zoophites, and the microscope had not facilitated our penetration into a part of the creation, till then invisible, though, not less wonderful and various than the visible.

There are forty species of animal anemones or actiniæ. They are beautiful in structure, and wonderful in their economy. They are of a cylindrical figure, or pear or funnel-shaped, but often like a marigold or rose. They are found firmly fixed on the rocks washed by the sea. They swell or contract at pleasure. They devour fish, crabs, &c. as well as flesh. They spread their numerous arms, or tentacula, and if one seizes any prey, the rest unite in securing it, and carrying it to the mouth. They are hermaphrodite, and cast their young from their mouth; and they often divide and become two animals, and also if cut into several parts; while, if torn away, the very shreds become perfect actiniæ. They cannot live in fresh water. They have sensitive feelings, shrink in case of danger, and enjoy the light, but no eyes have been traced. They can float in the sea.

The zoophytes which produce coral reefs are of the genera Meandrina, Caryphyllia, and Astrea. The reefs are curvilinear, with a lagoon in the centre, which gradually fills up—the younger and smaller zoophytes being in the inner circle. They raise it to the level of low water, and then stop. Fragments raised from the deep raise the wall above high-water. Tides and currents carry to it trunks of trees, herbage, &c., and it soon becomes the resort of birds.

Coral reefs are seldom 40 fathoms high, and generally but 15. The insects prefer shallow water and light.

Every tropical reef is bristling with corals, budding with sponges, and swarming with crustacea, echini, and testacea. Every tide-washed rock is carpetted with fuci, and studded with actiniæ, &c.—*Lamark.*

Crustacea contributes, as well as corals, insects to the raising of reefs; yet the increase is not above six inches in a century. If the water, therefore, is 500 feet deep, the raising of a reef must have employed 50,000 years.

Radiata have their organs of motion and sensation on each side of an axis.

Zoophytes approximate to vegetables, and respire by the surface. But they have no nervous system, or passage from the intestines.

The numbers of the Medusa, a genus of

zoophytes, are beyond calculation in the Greenland seas.

Owen describes cylindrical flexible mollusca, in the sea near Benguela, a foot long, and two inches in diameter, which, agitated, become vividly luminous.

Blue coral, is fished in the gulf of Benin.

All corallines have an apparent identity of existence in the whole branch, besides the separate identities of the innumerable insects which occupy them.

The hydra-polypus is found in stagnant fresh-water, consisting of a main trunk, with buds of young, often two or three generations on one stalk.

Polypes are mere naked stomachs, such as those covered and enclosed in higher animals. Nature seems to begin with the *monas*, proceeds to the *polypus*, then to the polypus with *feelers*, then with feelers of *muscles*, *bones*, *nerves*, *&c.*

Two polypes cut asunder, and joined at either end, become one; and one species may be turned inside out, and live as before, which arises from their being mere absorbents, and without any centre of life.

Polypi have *tentacula*, by which they fix themselves at one end, and extend them at the other end in various shapes and colours. The larger kinds are called animal flowers, and they often resemble a flower-garden on rocks and in the sea.

Sponges are believed to consist of excitable flesh, full of small mouths, by which they absorb and eject water.

Sponges are cities of animalculæ, their porosities being like streets and lanes, and the animals living in minute holes in the partitions. Sponge is obtained in commercial abundance at the Island of Sime, near Rhodes. It is brought up by male and female divers, whose endurance of water lasts ten or twelve minutes.

Bory de St. Vincent makes 82 genera of Microscopic Animalculæ. 400 species have been drawn. But the *gas microscope* proves that the study is in its infancy. The animals, too, have been under-rated, for they display choice, will, passion, locomotion, and have at least the sense of seeing in high perfection. Size seems a merely relative circumstance.

Infusoria, so little contemplated, have been raised by Ehrenberg into scientific estimation. He feeds them with agreeable coloured substances; and hence, has discovered their masticatory organs, their stomach and stomachs, their intestinal canal, their generative organs, muscles, nerves.

They propagate so rapidly, that he calculated the *hydatina senta* might, in twenty days, become a million, and in twenty-four days 17 millions. Some divide themselves, and so multiply rapidly.

They see, for they move with precision and purpose; and they think, for they avoid danger, and display artifices. In fact, they have all the appendages of larger insects, and often some peculiar to themselves, but difficult to understand.

They are produced by mixture of various substances in fluids; and by some supposed to be spontaneous generations, while others have referred their origin to various causes.

Hempseed, rice, lentils, peas, pepper, beet-root, blighted corn, &c. all yield various kinds on being macerated in water; and, however much boiled, the smaller kinds appear. Vinegar, too, produces eels; and all animal substances in putrescence display them. There are none in fresh rain-water, or pure spring-water. Sea-water produces them in swarms.

If paste made with flour and water is suffered to go sour, without becoming mouldy, the surface will soon be found covered with an infinite number of minute living beings, which, from their general similarity to that animal, have been called eels. The same animals, or, as some authors think, a different species, is found in bad vinegar, and other mild acids. These animals are viviparous, and their increase is astonishing, for a hundred or more have been seen to issue from one of them.

Lewenhoeck saw hundreds of animalculæ in the space of a grain of sand, and he says ten thousand organized beings. A drop of water contains hundreds, all in extreme activity, swimming or crawling with freedom and purpose. They appear to subsist on the atoms of the infusion, or they prey on others. Some have the form of flying-dragons with all their parts, others are like polype, some like worms, others with many legs like insects, while others have machinery of wheels which turn, creating vortexes which enable them to collect food. Some are like plants, with branches, each terminated with animalculæ, and the trunk and branches alternately draw in and spread. Others are like hydatids, and evolve their generations from the skin; and all hermaphrodites.

The principal species is called *vorticella*, from the mouth being surrounded by numerous short feelers, forming a kind of fringe round the head; and, by the motion of these feelers, they form an eddy or vortex in the water, which draws prey into their mouths.

The *volvox globator*, or globe animal, is one of the most curious, as well as one of the most beautiful of the animalculæ. It is found in the clearer kinds of stagnant waters, and often equals the size of a pin's head. Its general colour is green, but it is sometimes of a pale orange. Its motions are irregular in all directions, and at the same time rolling or spinning as if on an axis. When microscopically examined, it presents one of the most curious phenomena in natural history, being always pregnant with several smaller animals of its own kind, and these with others still smaller.

Mouldiness resembles a forest of perfect trees.

The vorticelli and other animalculæ have the power of resurrection, and after being dry grains for years, revive again on being put in a drop of water; and this may be repeated 10 or 12 times, if they are kept in sand, however dry.

The little animal which makes rapid cir-

cles on water is the gyrinus, or water-flea. When disturbed, they dart into the water.

None are to be found in wines, or any other fermented liquor which has not passed into the state of vinegar, or which has not become completely vapid, neither are they to be found in distilled or spring-water.

They abound as a sort of tad-poles in the semen of all male animals, from man to the smallest insect. The presence of animalculæ in male semen, and no other animal fluid, led Spallanzani, Fontana, &c. to conclude that the larger animals are merely expanded animalculæ, aided by the economy of the female parent, by food, &c.

Air destroys many animalculæ, also heat and cold, but the eels in vinegar survive repeated freezings.

The foul matter of dirty teeth abounds in a sort of eels. Diseases of the skin are generally occasioned by them, or they accompany such morbid parts.

The itch, according to Willan, is caused by an insect, white, with eight reddish legs, to the four hind-ones of which is appended a bristle. It may be distinguished in the joints with the microscope in the vesicles which accompany the disorder. On the same authority we learn that most of the diseases of the skin arise from other insects.

The *monas*, a water hydatid or viscid bubble, is the first germ of animal secretion, or stomachic absorption, which indicates irritability. When found in man and animals they are called *bots*.

The monas, is the 9600th of an inch in diameter, so that 885 thousand millions would form but a cubic inch.

Mites are found not only in cheeses but in preserves, meal, dried flesh, and other articles of domestic consumption. They have as regular a figure, and perform all the functions of life like creatures that exceed them many times in bulk. They have a sharp snout, and a mouth that opens and shuts like a mole's. They are so extremely quick-sighted, that when they have been once touched with a pin, they avoid a second touch. The various parts of the body are covered with long hairs, and even these hairs are bristly. From the eggs of the females the young are hatched in twelve or fourteen days, and are so small, that ninety millions are not equal to a pigeon's egg.

Ehrenberg keeps and feeds animalcules of different species like so many birds.

The hollyhock has twelve species on the upper surface of the leaves, and the under surface is covered with their eggs.

Luminous animalculæ in sea-water are the size of a poppy seed. By day-light they appear like drops of grease, and they aggregate in groups like balls. They are called *noctiluca miliaris*.

The phosphoric light seen in the ocean is caused by innumerable quantities of these phosphoric insects, and is sometimes so intense as to make the waves appear like red-hot balls.

Brown lately promulgated the idea that all atoms were animalculæ, because, when diffused in liquids, they obeyed the motion of the atoms of that liquid. Maten published a similar theory, founded on the same mistake, and on the phenomena of revivification by immersion. It is supposed that the animals and their eggs are involved in the fluids of vegetation, and fixed in the substance till revived. Some have supposed that vegetation generates them, and that they are the primary existences which afterwards expand into species of animals.

Cary's exhibitions of the *hydro-oxygen* microscope, illumined by a pea of lime, exhibits several hundred subjects of many different forms and species in a drop of putrid water: and all are put in great activity by the excessive light to which they are suddenly exposed. The variety is greater in summer and autumn, and certain ditches produce certain kinds.

Previously to the discovery that a small pea of lime, or chalk, exposed to a blow-pipe of oxygen and hydrogen, affords for some time a light nearly equal to the Sun, the greater powers were limited to the solar microscope; but now we are independent of hours and weather, so that objects magnified many thousand times can be examined at leisure. Hence, The Wonders of the Microscope is now the most instructive of books for old and young.

Ehrenberg has found silecified remains of infusoria, and that the slimy iron ore of marshes is covered with infusoria.

A man as to the globe is like the smallest animalculæ seen with microscopes, *i. e.* but the 8 millionth the diameter.

VEGETATION, OR BOTANY.

Vegetation is that evolution of germs, and that fixation of the elements, which serves as the food of loco-motive evolutions in animal forms; for, though some animals devour one another, yet the devoured have been sustained by vegetation.

Vegetable substances are the first term in the progression of substances, ending in the genera and species of all kinds of animals, and without vegetable preparation, mineral and earthy substances could not become animal substances; for though shells and bones are deposits of lime, yet the lime enters the animal after the preparation by vegetables. They are evolved by heat and light, and from air and water, in all situations where their food in the soil is not rendered intractible by metallic diffusion, and their varieties and universal distribution fit them for their end.

Brogniart estimates the known Flora at 50,360 species, of which 10,200 are *Cryptogamus*, (the 24th class of Linnæus,) and 40,150 possess visible organs of reproduction, or are *Phænerogamous*.

Linnæus distributed 1260 genera into 7540 species.

Stendel makes 3376 genera and 39,680 species of *phænerogamous* plants, and 557

genera and 10,965 species of *cryptogamous*. That is, 50,645 species.

The ancients knew but 1400 species.

Britain alone has now 3400.

Linnæus made about six species to each genus, but Persoon extended the species to an average of ten; and Stendel makes twelve.

De Candolle reckons 60,000 species, but Keferstein only 32,000, besides 803 fossil.

Some modern botanists carry the number of known species to 110,000. Europe contains half the number. Asia 4-5ths, and America 7-8ths. The Southern hemisphere is scanty, and proves itself in this respect to be elevated land.

The Linnæan system consists of twenty-four *Classes*, and twenty-six *Orders*, now divided into 3900 genera; into 50 or 60,000 species; and into an almost infinite number of varieties.

The twenty-four *Classes* depend on the number of stamens, and the twenty-six *Orders* on the number of pistils.

The twenty-four CLASSES are called according to the number of *Stamens*:—

1. Monandria.	13. Polyandria.
2. Diandria.	14. Didynamia.
3. Triandria.	15. Tetradinamia.
4. Tetandria.	16. Monadelphia.
5. Pentandria.	17. Diadelphia.
6. Hexandria.	18. Polyadelphia.
7. Heptandria.	19. Syngenesia.
8. Octrandria.	20. Gynandria.
9. Enneandria.	21. Monesia.
10. Decandria.	22. Diœcia.
11. Dodecandria.	23. Polygamia.
12. Icosandria.	24. Cryptogamia.

The ORDERS are as under, depending on the *Pistils*:—

1. Monogynia.	15. Siliquosa.
2. Dygynia.	16. Polygamia equalis.
3. Trigynia.	17. Polygamia segregata.
4. Tetragynia.	18. Monogamia.
5. Pentagynia.	19. Monœcia.
6. Hexagynia.	20. Diœcia.
7. Octagynia.	21. Triæcia.
8. Enneagynia.	22. Fillicea.
9. Decagynia.	23. Musci.
10. Dodecaginia.	24. Hepaticæ.
11. Polyginia.	25. Algæ.
12. Gymnospermia.	26. Fungi.
13. Angiospermia.	
14. Siliculosa.	

The sexual system has been understood in the East, from remote antiquity, and is made use of in fructifying many fruit-trees. It is spoken of by Theophrastus, and Grew distinguished between stamens and pistils.

Van Royen, of Leyden, after Linnæus, taught another system; Gleditch another; and Haller, a third. The Jussieus then promulgated a natural system, founded on the habits and affinities of plants.

Jussieu divides plants into three divisions; the *Acotyledons*, when the seeds are destitute of lobes; the *Monocotyledons*, with one lobe; and the *Dicotyledons*, with two lobes. The *first* includes what Linnæus calls *cryptogamia*; the *second* is divided into three classes, of four orders. The *dicotyledons* are divided into eleven classes, of seventy-eight orders.

In other words, *monocotyledons* have only one lobe in the seed. Their leaves spring from the root, as in palms, lilies, onions, leeks, &c. *Dycotyledons* have two lobes and produce trees with wood, pith, and bark *Acotyledons*, as mushrooms, mosses, &c. are cellular texture only. The others are cellular and vascular, differently disposed.

As many vegetables grow from the root in external layers, botanists have called these *exogenous*; while those whose root acts differently, or by the axis of the plant, they call *endogenous*.

Stamens are five or ten in *Exogenæ*, and three or six in *Endogenæ*, and they consist of filament and anther. The pistilla, also, vary in number. When both are in the same flower it is hermaphrodite or perfect.

Linnæus laboured till his death at another classification, founded on more popular distinctions, and this has been perfected by Lamarck, Jussieu, and De Candolle; the latter of whom has published a system, and arranged all the species under seven classes, corresponding to the 15 of Jussieu.

Plants may be classed as the internal plantlet is enclosed by one, more, or no cotyledon, which forms the seminal leaf, leaves, or none. There are 6000 species which have one leaf, called *mono*cotyledons; 32,000 have many, called *di*cotyledons; and 6000 have none, called *a*cotyledons; in all, 44,000 species. The plantlet is the future plant in miniature, as well in seed as buds.

Many plants are composed entirely of cellular tissue and ducts, as equisetacea, felices or ferns, marsilaceæ, or floating-plants, and lycopodiaceæ, in mosses, or on trees. Others, of cellular tissue only, as mosses, hepatica, algæ or water-plants, lichens, fungi. All which have no visible organs of reproduction in stamens and pistils, and are cryptogamous, or *Agamous*.

All having stamens and pistils, or evident sexes, are *Phænerogamous*.

The corolla are the leaves or petals of the flower, one, two, three, or more; and hence *mono*petalous, *di*petalous, &c.

Plants of different genera have similar qualities; Gray says there are *four greater carminative hot seeds*: anise, carui, cummin, and fennel.

Four lesser hot seeds: bishops' weed, stone parsley, smallage, and wild carrot.

Also *four cold seeds*: cucumber, gourd, melon, and water-melon.

And *four lesser cold seeds*: endive, lettuce, purslain, and succory.

Four sudorific woods: guaiacum, perfumed cherry, sarsaparilla, and sassafras.

Four cordial flowers: borage, bugloss, roses, and violets.

Four carminative flowers: camomile, dill, fever-few, and melilot.

Four resolvent meals: barley, bean, linseed, and rye.

Again, he gives to others a quintuple affinity as *five opening roots*: asparagus,

butcher's broom, fennel, parsley, and smallage.

Five lesser opening roots: caper, dandelion, eryngo, madder, and restharrow.

Five emollient herbs: beet, mallow, marsh-mallow, French mercury, and violet.

Five capillary herbs: hart's tongue, black, white, and golden maidenhair, and spleen wort.

Culmiferous plants are wheat, *triticum*. Rye, *secale*. Barley, *hordeum*. Oats, *avena*.

Leguminous plants are potatoes, *solanum tuberosum*. Turnips, *brassica rapa*. Peas, *pisum*. Beans, *vicea fabia*. Carrots, *daucas*. Parsnips, *pastinaca*. Cabbages, *brassica oleracea*. Burnet, *poterium*. Beet, *beta*.

Herbaceous plants are flax, *linum*. Hemp, *canabis*. Rape, or cole-seed, *brassica napus*. Woad, *isatis*. Hops, *humulus*.

Cellular tissue is transparent, cohering vesicles.

Woody fibre is elongated, or tubular cellular tissue.

Spiral vessels are elastic tissue, so turned or twisted as to form a tube, but capable of being drawn out. They conduct the sap, &c. on a continued inclined plane.

Ducts are other tubes, which do not draw out or unrol.

Deciduous trees are those whose leaves fall off every year, as opposed to evergreens.

The mass, caudix, or trunk and root of all vegetables are, 1. an epidermis covering pulp. 2. Rind, pulp, longitudinal fibre. 3. Bark, wood, and pith, vascular and cellular.

The generic name resembles the family or sur-name of men; and the name of the species, that of the baptismal name of each individual of the family. As *pyrus*, for the apple-family; then PYRUS *malus*, the apple strictly; PYRUS *sative*, the pear; and PYRUS *cidonia*, the quince.

The marks used by botanists are ⊙, an annual; ♂, biennial; ♃, triennial; ♄, a shrub or tree; Δ, an evergreen; ♀, pistilla and no stamens; ☿, both pistilla and stamens.

Animal and vegetable life is a continued succession of dispersions and renewals—of eliminations and assimilations—from the first excitement of the germ or seed, till the exhaustion of the functions and the decay of the powers of renewal, followed by death, or dispersion in gas, or unconnected particles.

There are two generic kinds of organization, adapted to produce very different results. In one the absorption of the assimilations are by roots from the soil of the earth, as in vegetation; and, in the other, the absorption of the assimilations are from a selection of soil prepared by vegetables and put into the stomach. The first is primitive, and the latter is consequent on the first, and dependent on it.

It is difficult, if not impossible, to determine the boundaries of the animal and vegetable kingdoms. Vegetables ascend to animals, and these descend to vegetables, so closely up and down, that naturalists cannot agree in the line of demarcation. Hence, many think, that the superior and most contrasted of each kind, may be ramifications or transmutations from the lowest, or most alike of each; especially, as in early geological periods the pabulum was scanty.

The succession of organizations appears to be mineral, vegetable, and animal, and the kinds run into, or join, each other by imperceptible gradations of approximation. Molecules, or atoms of matter operated on by the action and reaction of the elements, produce minerals. These acted on by the elements, produce the cryptogamia, and these work their way to the sexual system of reproduction by the finest gradations.

Vegetables, as fucoids, lichens, mosses, &c. &c. were the first germs of vegetation, and they are found abundantly in the ancient grauwacke slate formations, to the number of 100 layers in 20 feet. Their remains were the first soil for superior plants, and these then became the support of the first evolutions of fixed and loco-motive animalization, after the transition lime formations above the grauwacke.

The whorls of Goëthe result from indifference of action on all sides of a centre. The results are a concentric circle, or sphere of phænomena. A germ evolves from the womb of nature, and its actions and reactions are equal on every side.

Growth is the effect of the excess of the powers of assimilation; maturity is the balance of the assimilations, and eliminating functions; and decay is the excess of the eliminating. Germs are similar in the same species, and their varied results in growth and maturity depend on the soil, air, culture, pabulum or food, and on all the external circumstances.

Cuvier says, the bark of the earth was not made by a single cast.

The transition of cryptogamic plants into monocotyledons, of these into dicotyledons, result from the action of different soils and different proportions of the gaseous elements.

The improvements of plants and fruits by manuring, grafting, &c. and the enlarging and varying of breeds of animals indicate plain principles of production, and afford data from which we may reason in a series from the state in one age to that of former ages. Bakewell used to say, that he could totally alter the shape of any animal in a few generations. Young and Knight said the same of plants.

Chemistry of Vegetation.

Gay Lussac and Thenard have deduced three propositions, which they call *laws* of vegetable substances.

First.—That a vegetable substance is always acid, whenever the oxygen it contains is to the hydrogen in a greater proportion than in water.

Second.—That a vegetable substance is always resinous, or oily, or spirituous, whenever it contains oxygen in a smaller proportion to the hydrogen than in water.

Third.—That a vegetable substance is

neither acid nor resinous, but either saccharine or mucilaginous, or analogous to woody fibre or starch, whenever the oxygen and hydrogen are in the proportions of water.

The Chemistry of *Vegetation* consists in the decomposition of the aqueous solution of the soils; and re-combination of the elementary constituents in the membranes, fibres, and cellular and vascular tissues of the bark, wood, pith, or marrow. The fine membrane forms mucilage, and in cells, chiefly hexagonal, pervades the whole plant. The chemical decompositions in plants are believed to be effected in the leaves, in which the sap is exposed to the action of the air.

Vegetables are composed of carbon, oxygen, and some hydrogen, with nitrogen; and they mainly produce gluten, farina, mucilage, oil, and sugar.

The chemical growth of plants is proved by fuci, which thrive without roots. The epidendrum grows, flourishes, and blossoms, when suspended in a room, by decomposing the air and absorbing vapour.

Vegetables are, therefore, believed to derive their support as much from the atmosphere as from the soil, by a galvanic process. The disintegration of rocks, and the decomposition of vegetables and animals, preserve the equality and necessary variety of soil.

The ultimate and proximate principles of all vegetation are oxygen, hydrogen, carbon, and occasionally nitrogen.

When there is an excess of hydrogen, then unctuous and inflammable bodies are generated, as fixed oil, volatile oil, resin, caoutchouc, camphor, and wax. In the division containing nitrogen is vegetable gluten.

When the oxygen and hydrogen are combined in the same proportions as in water, the substances are not acidulous, but consist of sugar, gum, starch, wood or lignum, tannin, and what is called extractive.

Vegetables contain, in substance, acids, sugar, gum, mucus, jelly, starch, gluten, and five or six peculiar principles, as tannin, indigo, the bitter and narcotic principle, &c. They also yield oils, wax, resins, &c. In all about 34 several products.

Vegetables yield nine several acids: the oxalic in rhubarb; the tartaric in tamarinds, grapes, and mulberries; the citric in oranges, lemons, and onions; the malic in apples, cherries, &c.; the gallic in elm, oak, &c.; the benzoic in balsamic trees; the prussic in laurel-leaves, peach-blossoms, and bitter kernels; phosphoric in barley, oats, &c.

Plants are the first decomposers of minerals into their elements; and they also assimilate the constituents of air and water; and, therefore, are nature's chemists. Pharmacy has in some degree superseded them; but, till within two or three hundred years, they were medicine as well as food. Their various virtues were seized on by superstition, and for many ages they were connected with the fancies of astrology. The day was divided into planetary hours; and no plant was believed to have its virtue, unless gathered in the hour of its planet, and also at a particular age of the moon.

The evaporation of vegetables consists of water and minute portions of gummy matter, and carbonate and sulphate of lime.

A retention of the oxygen, for want of light, renders plants white; and its excess produces the same effect.

The colours of flowers depend on light; and the colouring matter which they yield becomes red when an acid is added to it; and violet, blue, or green, when an alkali is added. Flowers decompose no carbonic acid, but they convert the oxygen in the air into carbonic acid.

Vegetation converts the gas of the atmosphere into an equal bulk of carbonic acid gas, without affecting the azote. When no oxygen is present, they either form carburetted nitrogen, or carburetted hydrogen, always evolving carbon.

The epidermis of canes, reeds, and grasses, contains much silex.

By day-light plants abstract carbon from carbonic acid gas, and oxygen from water; in the dark they give out carbon, and absorb oxygen.

Plants of a succulent nature require strong light, with much given surface, and have resinous juices.

Fungi, without colour, grow in darkness; mosses, ferns, &c. grow best in shade.

Light separates the moisture in plants into its constituent hydrogen and oxygen, and it disengages the oxygen from the carbonic acid, so as to deposit the carbon in union with hydrogen, as gum, resin, and oil, which forms their ligneous parts. Consolidation and vigour depend on light.

The closing and expanding, or sleeping and waking of flowers, are governed by darkness and light.

Linnæus says, that *yellow* indicates bitter flavour; *red*, acid or sour; *green*, a crude alkaline taste; *pale-green*, insipidity; *white*, luscious; *black*, harsh and nauseous. *Green* is most common, and *black* the most rare. No flower has its proper colour till in full bloom. Some change twice or thrice. Red changes into white and blue: blue into white and yellow; yellow into white; and white into purple.

Scotch pine contains 83 of volatile matter, ash 81, and sallow, birch, and Norway pine 80. Lignum vitæ but 73. Other woods intermediate. Lignum vitæ, mahogany, and laburnum, afford above a quarter charcoal, or 26 in 100; chesnut and oak 23 in 100. Pit-coal gives 75 per cent. of coke.

Leaves are coloured in the proportion in which acids and alkalies prevail in them; green indicates an excess of alkali. Solar light is the agent by which the carbonic acid in gas is decomposed. The oxygen is thus expelled, and the alkali produces green.

Fleshy leaves absorb oxygen in the night, and give it out in the sunshine. They produce carbonic acid, and also decompose it; and, therefore, do not vitiate the air. In a close vessel they deteriorate and restore air

The metallic poisons and mephitic gases which kill animals, also kill vegetables.

In plants, azote or nitrogen is only found

accidentally. Their nutriment is water, decomposed into hydrogen and oxygen, with air and carbonic acid. They retain the hydrogen and carbon, and exhale the oxygen by aid of light. Animals, on the contrary, absorb and fix nitrogen. Plants produce water and carbonic acid, and animals reject them. Plants exhale oxygen, and absorb carbonic acid; and animals absorb oxygen, and exhale carbonic acid.

Oxyde of carbon, or what is called humic acid, is said to be the food of plants. Turf contains the most of it; heaths the least.

Atmospheric pressure is intimately connected with the growth of plants.

The pabulum of vegetation is, by ignorant man, carried away with crops. Part may be restored by manure, from cities where the crops are consumed, but it can be but a tithe or a centum. Cultivation may turn up unexhausted soil, and sometimes a fructifying substratum, but the annual carrying away will, in a certain time, be fatal to future fertility. A rich country thus becomes gradually poor. What would England be without its annual products of 100 millions? This exhaustion, therefore, is the secret of the poverty of all old countries, without any superstitious malediction or prophecy.

Nor in the absorption by roots is the mineral soil indifferent, for growth and fertility depend on due mixture of soils containing various elements; on moisture, which consists of hydrogen and oxygen; on air, compounded of nitrogen and oxygen; and on heat, or atomic motion, which last seems to be essential to the due developement and mixture of all the others. Form and fitness are also necessary in the germs, and these, by various actions and reactions on the elements, and by secretions among themselves determine the results.

Plants with a spongy tissue, with large soft leaves, with no hairs, of rapid growth, with no resin, and many roots, require moist scites.

Water, or soil, ought to abound in the elements which the plant secretes. Cruciform plants, and fungi, require animal manure, &c. for their azote and lime is necessary to those whose analysis gives an excess of earths. So saline waters are necessary to those which yield soda.

Gærtner thinks that the germs or embryos of plants are products of the fluid of the pollen, combined with fluid matter secreted by the stigmata. Strange pollen attaches with less force to the stigmata, than the pollen of the plant.

Germs of vegetables and animals originate in the male; and in animals it may be seen by the microscope, as animalculæ, often like tadpoles, and sustained and matured by the female to their state at birth. Afterwards they expand to the *limit* determined by their ratios of assimilation and elimination.

The first lively germ is but the fourth of a grain, and the fully-expanded animal is to the primitive germ 28,000 × into the weight in lbs. to 1. In plants and trees the grains of pollen to the expanded plant or tree are still more disproportionate.

The principle of continuity in all organic existence is nearly the same.

The seed of plants consists of three parts; the cotyledon or side lobes, the radicle, and the plumula. The radicle is the germ of the root, and the plumula the stem of the plant.

Germination depends on heat, moisture, air, and rest.

The seeds of plants are their eggs. A sunflower produces 4,000; a poppy 30,000; a tobacco-plant 3 or 400,000; and spleen-wort 1,000,000. Some, as the sea-pink, have but one seed, umbelliferous flowers two, and the spurge and ranunculus three. The capsule of the white poppy contains 8,000 seeds. Some seeds germinate after boiling. The seeds of mosses germinate either in hot earth, or in water.

The radicle and plumula germinate at an angle of 90°, and hence one spreads in the ground and the other rises.

Seeds and Germs.

Grains of wheat in different countries yield from 6, 10, 16, and even 30 to 1. Cape wheat 80 to 1, and Barbary 50. Barley yields from 50 to 120. The sarrazin of Tartary yields from 50 to 2000 grains for 1. Oats increase from 200 to 2000.

Wheat and millet-seed germinate in 1 day, barley in 7, cabbage in 10, almond, chesnut, and peach, require 12 months, and rose and filbert 24.

Singular cases of wheat-increase was one near Bath, where one grain produced 73 stalks and 7445 grains; and Millar, the botanist, produced 500 plants from one grain, and 576,840 grains, weighing 47 lbs.

Peas and scarlet beans increase from 300 to 500 fold.

Reeds in Brazil grow from 30 to 40 feet, and grasses from 6 to 7 feet.

A peach-tree has yielded 1560 peaches, and a rose-tree from 1 to 2000 roses.

An acre of potatoes yields 2700 lbs. of flour, and wheat but 1300 lbs. In equal weights wheat yields 2½ flour, potatoes 1, barley 1¼, and oats 1½.

The malva sylvatica yields 200,000 seeds, the orchides 8,000. The date gives 12,000 flowers on one spatha, and every bunch of the seje palm has 8000 fruit.

Man for his wants, animals and birds in their excrement, and the atmospheres, rivers, and ocean, are extensive diffusers of exotic seeds.

The seeds scattered by birds in their excrements are more fructifiable from passing through their bodies.

Linnæus states the plant of one poppy-seed has produced 32,000 seeds, and one of tobacco 40,320. Such numbers to 1, are the natural odds against mere continuity.

Wheat, barley, &c. the staff of life, are derived from the feeble tribe of grasses.

White *clover* springs up on mixing lime with dry heaths and barren soils; and raspberry-bushes spring up where fir-woods are burnt down. Other plants rise, also, as underwood in the decayed fragments of fir,

trees, though in each case strangers to the vicinity.

In turning up soil from great depth, new varieties of vegetables generally arise. Old garden-pots newly dug up exhibit the revival of seeds long buried.

At Kingston-on-Thames, soil brought up from a depth of 360 feet, and then covered with a hand-glass, exhibited speedy vegetation.

As the sea retires from a shore, various plants spring up, wholly strange to the neighbouring land.

Seeds buried in old garden grounds, and turned up after many years, become plants, and deep ploughing always produces a latent crop of anciently buried seeds. A bulbous root found in the hand of a mummy above 2000 years old, lately produced a plant.

A field of wheat buried under an avalanche for 25 years, proceeded on its growth, &c. as soon as the snow had melted.

Potatoes planted below 3 feet, do not vegetate; at 1 foot they grow quickest, and at 2 feet are retarded two or three months.

If we give credit to the spontaneous generation of plants from various earths, we establish the connection of plants with earth; but as the succession of nature is mineral, vegetable, and animal, we have to examine the origin of animals from vegetables, and not directly from earths. Then we know that vegetable matter produces infusoria, maggots, worms, and the like, as may be presumed from the mere action and re-action of the elements. The sexual system of plants is strictly analogous to that of animals, and both sexual systems may be grades of one another.

Cellular or cryptogamus plants are propagated by the dilation of a part called a sporule, something like the increase of polypi. They are nurtured by moisture, but the pollen is considered as a sporule which requires the nurture of the juices of the plant.

Germination appears to be an action taking place between the olefiant gas, which has been previously formed by a vinous fermentation, and the oxygen of the atmosphere; and is effected by the peculiar operation of the plumula and the rootlets. This decomposition and combination of the different elements go on, in well-regulated processes, as long as there is any farinaceous matter to be decomposed: the food of the plant being at this time always the oxygen of the atmosphere, and the newly-formed olefiant gas, differing in equivalent combination, according to the constitution of the plant.

Fruit is the sustenance of the seed, and resembles the after-birth, or placenta of viviparous animals.

All Fruit consists, in various proportions, of water, sugar, potass, malic acid, mucilage, tannin, gelatine, and a flavouring and colouring principle. The essentials in making wine from them are the sugar, tartarous acid, mucilage, and water. Flavour, colour, and tannin, are not essential. The tartarous acid distinguishes wine, and the malic cider. The sugar, by fermentation, yields the alcohol, with extractive vegetable matter.

The substance of fruit varies as it matures. Green apricots afford no sugar, but more advanced ·066, and when ripe ·165. The woody fibre is ·036, then ·025 and ·019: the proportion of water also is ·89, ·84, and ·75.

Fruit put into an atmosphere that contains no oxygen, does not ripen; but the ripening process commences when oxygen is supplied. The total weight of fruit in ripening is very little diminished. Heat produces saccharine matter in fruits; and heat without light will mature them.

The process of germination changes oxygen gas into carbonic acid, but does not affect the azotic portion of the atmosphere; it is supposed that the seed absorbs the oxygen, and gives out the carbon.

In a pear, shut in a close vessel for seventeen days, the ingredients were much changed: the sugar was doubled; and the gum, water, and woody fibre had decreased. 100 parts of the air contained 13¼ of carbonic acid, 7¾ of oxygen, and 79 of azote.

The sap of plants is mucilaginous, albuminous, and saccharine, in the alburnum; and astringent, or tannin, in the bark. The cambium, between the wood and bark, is a mixture of both. The sap consists chiefly of water, with a small portion of potass, some vegetable matter, and carbonate of lime.

Dutrochet considers the formed tubes as the sap-vessels, and the spirals as conductors of the gaseous results of the chemical action of the leaves on the atmosphere.

The odorous matter of flowers is inflammable, and arises from an essential oil. When growing in the dark their odour is diminished, but restored in the light; and it is strongest in sunny climates. The *fraxinella* takes fire in hot evenings, by bringing a candle near its root.

Geography of Plants.

Every district has its own Flora, the result of soil, climate, elevation, water, &c.; and though the types, or genera, in similar situations are alike, yet the species are distinct. De Candolle divides the earth's surface into 59 botanical districts, each with a preponderance of distinct species or genera of plants, proving their entire dependence on local, chemical, and mechanical causes. In fact, too, the metamorphosis effected by culture is another proof.

De Candolle's distinct botanical regions are the Arctic and Antarctic Circles. Middle Europe to the Altaic Chain, Eastern Siberia, and the Steppes of Tartary. The Mediterranean shores. The Euxine shores. The East Indies. China and Japan. New Holland. South Africa. Abyssinia and Mozambique. Middle North Africa. The Canaries. The United States. West of the Mississippi. The West Indies. Mexico. Tropical South America. Brazil. Chili. Magellania. Besides islands far from continents.

Humboldt localizes the 39,000 species

of plants and trees, (not cryptogamia) as under:—

Europe	7000
Siberia, &c.	1500
Tropical Asia	4500
Africa	3500
Tropical America	13000
Other parts ditto	4000
New Holland, &c.	5500

The quantities in lat. 0, 45, and 68, he considers as 12, 4, and 1.

Mirbel has drawn out a table of the species and proportions of 100 plants in four regions exclusive of the tropics. The region 1 of 30 and 33 N. lat., 2 of 40 to 50 N. lat., 3 of 60°, and 4 the arctic. Of grasses, he gives in 1, 503 species, in 2, 246, in 3, 134, and in 4, 36. Their proportion to all other vegetation is 0·061 in the 3 first, and 0·088 in the 4th.

Sedges are	195, 275, 90 and 33.
Lilies	180, 78, 38 and 1.
Orchis	106, 54, 42 and 5.
Palms only 3 in the first.	
Pines	34, 12, 9 and 1.
Goosefoot	104, 126, 47 and 0.
Plantain	65, 24, 12 and 3.
Figwort	298, 150, 93 and 23.
Heaths	37, 28, 32 and 27.
Compound	1168, 520, 223 and 41.
Umbelliferous	368, 182, 74 and 3.
Labiate	431, 135, 77 and 1.
Leguminous	975, 283, 155 and 16.
Pinks	382, 180, 125 and 35.
Cruciferæ	540, 252, 140, 50.
Ranunculus	192, 126, 116, 21.
Roses	200, 152, 108, 28.

Altogether he makes 10,292 species in the four zones, of which there are 8193, 3982, 2129 and 438 in the respective zones.

In the first 1262 are woody; in the second 357, in the third 193, and in the fourth but 46.

In the first 3861 have perennial roots; in the second 2610; in the third 511; and in the fourth 371.

In the Torrid zone, plants with one seed-lobe (*monocotyledonous*) are in proportion to those with two seed-lobes (*dicotyledonous*) only as 1 to 4. The former consist of grasses and palms, and the latter are European species. In the middle zones the two kinds are as 1 to 6, (and a sixth of all plants) while in the extreme north, the region of mosses and lichens; the one seed-lobe are to the two-seed lobes only 1 to 2. The ligneous exceed the herbaceous as we approach the line, and in forest-trees America has 120 species for 34 in the same latitudes.

In regard to the distribution of plants in localities, Linnæus divides them into aquatic, alpine, umbrosius, field and heath plants, parasites.

So connected are plants with one another, that the number of one species being given, the number of others may be determined in the same district.

Monocotyledons are 1-6th of the plants in the tropics, 1-4th in the temperate zone, and 1-3d in the frigid zone.

Ferns, heaths, and rhododendrons increase towards the Poles; and the rubiaceæ, euphorbiæ, and legumes, towards the Equator.

America has no heaths. Africa no laurinæ. The southern hemisphere no roses. Of 2891 species in the United States, only 385 are found in Europe. In South America, but 84 species belong to Europe. In Australasia, of 4100 species, less than 100 are found in Europe.

The mountains in South America present every temperature, yet Humboldt no where saw rose-trees or heaths.

All the vegetation of America is different in species from the same kinds in Europe. They often resemble, but are not the same.

All plants require *a definite* degree of heat; and, therefore, their growth and heat are mutual tests.

Between the tropics succulent plants prepare on rocks, &c. the mould for successors. In the temperate zone, cryptogamias are followed by ferns, and these by grasses, &c.

The natural classification divides plants into *acotyledons*, *monocotyledons*, and *dicotyledons*. The first increase from the Equator to the Poles, except ferns. In the second, the palms are tropical. Sedges and rushes increase to the north. The cultivated grasses, as wheat, barley, rice, &c. abound chiefly in the middle zone. The third are universal. Leguminous plants diminish from the Equator.

In England and Wales there are 2045 species of *acotyledons (fungi algæ, &c.,)* 416 *mono.* 1220 *dico.* In Scotland 2984 *ac.* 26 *mono.* and 823 *dicotyledons.*

Ireland has but 4 *ac.* 211 *mono.* and 682 *dico.* In all about 3400 species in the British Islands.

For food of animals and men, there are, of glumaceæ, in England and Wales, 294 species, and in Scotland 188. Of leguminosæ 69 and 43; of gramineæ 170 and 94; and of cruciferæ 73 and 56.

Trees indigenous to Great Britain are 2 species of oak, 5 of beech, the ash, maple, sycamore, hornbeam, lime, holly, white thorn, alder, birch, aspen, poplar, fir, and mountain ash. In England, forests are of oak and beech; in Scotland, of Scotch fir.

Cryptogamia are numerous in the British Islands. We have 310 species of mosses, and 519 of algæ, besides ferns, lichens, and fungi of all kinds, from the archil in Scilly, to the rein-deer lichen and Iceland moss.

Woods are a 12th of France, and a 24th of England; 2500 young trees are an acre.

Lichen in Lapland is 1 foot high. The lichen tartareus, or cudbear, is found there, and in Sweden and Norway, and exported.

The grain of Sweden is rye, oats, and barley. The trees are birch, pine, and spruce firs.

Italy abounds in leguminous plants, England in mosses, Germany in rushes and grasses, and Scandinavia in lichens.

The South of Spain sustains bananas, cayenne pepper, the sweet potato, the fig, orange, lemon, olive, pomegranate, the carob, dwarf-palm, cork, and chesnut.

Portugal has no oaks, beeches, or limes, but the trees are orange, olive, cypress, cactus tuna, and indas, with some elms and poplars.

Sicily cultivates the sugar-cane, date, custard apple, orange, citron, olive, vine, myrtle, laurel, stone pine, carob, and pomegranate.

The Western side of Greece produces prickly figs, and dates, and nearly all Greece olives, oranges, lemons, capers, grapes, vines, currants, almonds, and pomegranates. It is the native country of our flower-gardens, and supplied all Europe with the tulip, ranunculus, hyacinth, &c. It also yields much gum, laudanum, mastich, and tragacanth. They use mastich, cypress, and cedar for firewood.

The tree-pink grows only in Crete, the double cocoa-nut only at Praslin; the thrift, the scurvy-grass, and the rose-root will grow only in stony places.

The Jews had palms, dates, and vines. Dates ripen at 70°, and not less. Grapes will grow in 71° and 72°, but 74° is too hot for them. Therefore, 70° to 71° was the ancient temperature of Palestine; and it is nearly the same at this day. In fact, there is slight evidence that the temperature of the Earth has varied in 3 or 4000 years.

The Michaelmas daisy and the golden rod are a third of the compound flowers in the United States. America has not a single species of heath. The forests in America have far more species than in Europe, chiefly conebearing and amentaceous. America has 137 trees of 30 feet and upwards; Europe but 45.

The vegetation of South Africa is totally distinct from that of North Africa and Europe, and in South America the proportion to Europe is still less. The equatorial regions is the line of demarcation, and the plants in the North and the South seem to originate independently, though similar.

The river Yenisei, which separates Siberia from Europe, also separates the organic world, both in vegetables and animals. The argali, the musk, &c. appear among animals, and all the vegetation is derived from the Altaic mountains.

The vegetation of New Zealand is totally different from that of New Holland.

India produces cocoa-nut, beetel-nut, and rice, the great staple.

Pepper, cardamoms, and coffee, are produced in shady and elevated situations. Millet and hard grains are cultivated east of the Ghauts: wheat on elevated spots, and potatoes have been introduced by the English. Tobacco, castor-oil plant, and cotton, thrive where water is not abundant. The Indian fruits are the mango, the orange, the tamarind, the guava, the custard apple, or annona, the plantain, &c.

The Aurantiaceæ, or orange and lemon family, are Asiatic, and the Camellia and Thea, Chinese.

The medicinal barks, the mutisiæ, fuchsia, and cactii, are exclusively South American.

Within the tropics, the genera are similar, but the species differ.

Asia has the oriental plane, and America the occidental; in genus the same, but differing in species.

The Peak of Teneriffe presents five zones of different vegetation: for 7 or 800 feet it produces vines, corn, olives, &c. the second zone produces myrtles and trees; the third chiefly pines; the fourth and fifth produce little vegetation, and is very cold; the upper part is pumice-stones and lava.

The flora of distant tracts, even of the same continent, is very different. In distant islands, the flora of each is mostly its own. Thus, at St. Helena, of 61 species, but two or three are found elsewhere.

Humboldt determines that the floras of the mountainous Antilles and the Andes are different and particular. He describes the forests as gigantic and wonderful; and such is the over-production, that the parasite orchis, piper, and pothos on a single fig-tree would cover a large area, while they pass from one tree to another above 100 feet from the ground. The bamboo and the fern-tree characterise the scenery of the tropics.

In New Holland, &c. the vegetation is gloomy and sad, says Leschenault, and unlike all the rest of the world, with the aspect of our heaths and evergreens. The greater part are new genera, and those of old genera are new species. The leaves are small and spinescent, and even the grasses are stiff and harsh. The larger trees belong to the family myrthoideæ, and to the genus, eucalyptus and leafless acaciæ. He ascribes it to the dryness of the soil and atmosphere. Even South American vegetation, says Brown, is more distinct from Australian than the latter from African.

The *plantain* requires from 82° to 73°; and, therefore, will not grow beyond the 27th degree of latitude, or, at an elevation higher than 2000 yards.

The *sugar-cane* 82° to 73°, or within latitude 36°, or the height of 1800 yards.

The *cotton-plant* from 82° to 68°, and latitude 34°.

The *olive* requires from 66° to 58°, from latitude 36° to 40°.

The *vine* requires heat from 62° to 48°, and the winter not below 33°.

Wheat flourishes at a mean annual heat of 55°; but, when so low as 46°, neither wheat, barley, oats, or rye, mature.

Maize thrives in America to latitude 45°. Oaks will not grow above 62 or 63 feet. The Scotch fir grows to 70. The larch, pine, birch, and mountain ash, cease in N. Asia at 68; and at Hudson's Bay at 60.

Potatoes, barley, flax, and hemp, grow on the Alps from 5 to 5600 feet. The larch 1000 feet higher.

The limit of perpetual *congelation* has been theoretically calculated; it is made 15,000 feet at the equator; and from that to 13 000 between the tropics; and from 9 to 4000 between 40° and 59°.

Wheat requires between the tropics an

elevation of 4500 feet to produce ears, but 10,800 feet is its limit.

Wheat will not grow and produce in the South Sea Islands.

In general, palms, tree-ferns, and the parasite orchideæ, flourish only in the glowing tropics. The cruciferous and umbelliferous in the temperate zone. The coniferous and amentaceous in the higher latitudes.

Regions, similar in climate, &c. if distant, produce only analogous plants, but not the same in species. The two Arctic circles produce, for example, in the North the dwarf birch, but in the South its anologue is the different betula of Terra del Fuego.

The whole earth has but 10 plants common to each quarter.

The most universally distributed plants are the simplest in structure, as the agamous of Jussieu, or the cryptogamous of Linnæus. They seem to be evolutions of all soils.

The wheat harvest begins at Upsal, and in England, in the first days of August; at Naples, in June. Barley, second week in June. Cherries ripen at Paris, end of June; at Naples, early in May. At Upsal, the ash, poplar, &c. cast their leaves before Michaelmas; at Paris, in October; at Naples, in November. In England, the walnut is first defoliated; then the mulberry, ash, and horse-chesnut. Evergreens do not cast their leaves till new ones appear. Flowering is 7 weeks at Naples, and 3 at Paris, earlier than England, Upsal 5 weeks later.

Vegetation is arrested when the heat is too little to prevent the crystallization of the fluids, and keep up the circulations.

Long tap roots, which descend into depths of warm earths, old trees whose layers protect the pith, and fluids mixed with resin stand the cold of winter.

The pine, the spruces, the larch, &c. bear cold 44° below Zero; and, in that degree of cold, the larch, the stone pine, alder, birch, juniper, &c. become large trees.

Great summer heats confer strength on trees, to enable them to bear frosts. The weeping willow thrives in England with its hot summers, and fails in Scotland where the summers are colder.

The agents which excite the germs of all vegetation, are heat and light; and the food and substance are the elements in water, soil, and air. These are the expanding causes till the bulk equals the powers of the fibres, and then more food creates accumulation and disease, and the mass yielding to the centripetal force returns to the earth. This is the law of all things that grow, live, and mature.

Light as well as heat is so necessary to vegetables, that tropical plants will not grow in the frigid zone; and, we are compelled to infer, that they grew in them only when the tropics were from 90° to 100°, instead of 47° as at present. At that time, the perihelion would give 113° of heat, and the aphelion but 88°.

Locality in plants arises from soil and climate, then these determine the insect tribes, these the reptiles and birds, and these again the quadrupeds. It is the Law of Fitness, arising from subsistence and gregarious habits. The same law governs man in tribes of families, and in nations of tribes.

The currents and tides of the sea, rivers, winds, animal and bird excrement, extend the domain of plants. Wrecks and commerce also transport many.

The sea has its botanical districts. Algæ are universal, and called the marine plant, but particular genera and species flourish in certain seas. The Atlantic, from the Equator to the 40th degree, the West Indies, the coasts of Brazil, the Indian ocean, and the seas of Australia have all distinct species. The Mediterranean, the Red Sea, and the Euxine differ also. Algæ are so dense near the Equator as almost to obstruct navigation, and carried by currents to higher latitudes, the masses often near the Azores resembling irrigated meadows, and form wide-spread banks of sangussum, almost solid, whose ultimate descication must add to the crust and manure of the earth. They have splendid colours, and may often be drawn up 500 or 600 feet long.

Algæ are at once the green covering of stones, or surface of ponds; and those submarine forests which obstruct navigation, and grow to the length of 25 or 30 feet with trunks 2 feet round; and, in other cases, to 1000 feet long, and not 2 inches round. They also produce the first stratum of fertile soil, and in their decay are the first source of all vegetation; so that one order of vegetables grow out of relics of previous orders. Countless ages must have passed in the transition of Algæ into the food of vegetables, but as they increase so much in water, this explains the use of the alternate submersions of seas.

The green and red slime in damp and shady situations, are minute species of Algæ; the same rise on water, and in ponds and ditches are food for ducks and fish, but in the sea they accumulate in dense masses, and form weeds, laver, kelp, manure, &c. The sea-shores present many varieties, as leather-like leaves, some with pods, &c. called *fuci*. Others, called *conferva*, are connected and jointed, and found wherever there is water, and seem to be a link between vegetables and polypi. They abound, but are viewed as the rubbish of vegetation.

Laver is a species of Algæ, and kelp is made from another species.

Peculiar Vegetable Productions.

Arrow-root is a native plant of South America, and cultivated in the West Indies. It is a creeping root, with stalks about two feet high, and the roots, pounded and bleached, make the starch which is used as nutricious food.

The elymees, arenarius, and the sedge carex arenaria bind sand-hills like walls against the sea.

Aloes are soccotrine, hepatic, Cape, and horse. The heart of the *aloes-tree* sells in India for its weight in gold, under the name of tambac.

The *arum capanulatum*, on the continent of India, and in the Archipelago and Northern Circars, is cultivated and valued as the potato is with us, and as the yam is in the West Indies. The roots weigh from four to eight lbs. They are compressed tubers, from each of which is produced a large leaf, from one and a half to two feet high. The flower is very large and showy.—*Curtis.*

The poisonous mushroom is the agaricus muscarius, whose juice is used in Sweden to poison flies, and in Russia for intoxication.

The reed used in covering houses is the arundo phragmitis.

A gigantic fir, called the araucaria, which now flourishes only in Australasia, is often found in fragments, in a fossil state, in England.

Bamboo is, in the torrid zone, and in the East, a production of various most important uses. It grows from fifteen to sixty feet high, being from five to fifteen inches in diameter. It grows rapidly, as much as twenty feet in a few weeks. It flourishes wild in many places, but in China and other countries, is carefully cultivated. The soft shoots are cut and eat like asparagus, and sometimes salted, and eaten with rice. The hollow joints afford a liquid, and if not drawn off, a concrete medicinal substance. Decoctions of the leaves and bark are also prescribed. Its seeds are eaten as a delicacy; its large joints are used as buckets; and, in many countries, no other wood is used for building. Ships are framed out of it, and it furnishes masts and yards. Its leaves make fans. It is also used to make bows, and instead of lead-pipes, to convey water to great distances. It also forms writing-pens, and is woven into baskets, cages, hats, &c. Bruised into pulp, it makes fine paper: and it is also used for every kind of furniture.

The *Banana*, or plantain, is also one of the most useful of trees. Its fruit, 12 inches long and two thick, serves for bread; the leaves serve for cloth and covering. The root is perennial, but the stalk is annual, and grows to 15 or 20 feet. An acre planted with bananas yields 20 times more aliment than in grain. The bannian is the sacred tree of the Hindoos. Every branch shoots a new root to the ground, so that they spread indefinitely, and afford shady retreats for comfort and religion.

The *Cocoa-tree* supplies the Indians with bread, water, wine, vinegar, brandy, milk, oil, honey, sugar, needles, clothes, thread, cups, spoons, basons, baskets, paper, masts for ships, sails, cordage, nails, covering for their houses, &c.

Our *Cocoa* is the cacao of the West Indies, and is the seed of the cacao-tree. Twenty-three millions of lbs. are consumed in Europe, and it is the general beverage of Spain. *Cocoa* trees are from 40 to 60 feet, with leaves 12 or 14 feet long, with 6 or 9 clusters of 10 or 12 nuts, near the top. They produce timber, coverings for houses, oil, arrack, and cordage. The oil is used and preferred all over the East for light and soap, and excellent candles and soap are made from it in London, clearer and sweeter than tallow or whale oil. Ceylon exports three millions of lbs. of cordage only. *Chocolate* is cacao-nuts roasted, powdered, mixed with water, and dried in cakes. But, in England, it is adulterated with flour and Castile soap.

The *Coco de Mar* grows only in two of the Sechelles. It is a palm from 60 to 80 feet, and the nuts fetch high prices.

Cocoa-nuts have the fruit in every stage of growth on the same tree.

Bananas, plaintains, and hogs, supply all the wants of the Polynesian Islands, without care or cultivation.

The *chinchona* tree, which produces the Peruvian *bark*, flourishes chiefly in the elevated plains of Quito.

The cultivation of indigo in Bengal occupies 12 million acres on the banks of the rivers, and employs nearly 5 million families, and an annual outlay of 16 millions rupees. The annual produce varies from 95 to 130,000 maunds.

The *Cotton plant*, or *genus gossypium*, contains 10 species, and is extensively cultivated in warm climates. It belongs to the class *monodelphia*, and the order polyandria. The seeds are enclosed in a capsule, and involved in the filaments called cotton. The plant is raised from seed sown in holes in the spring months. The superfluous plants are pulled up, and the others pruned to the height of four feet. The seed springs up in a few days in showery weather, and the cluster of plants is weeded when they are a few inches high. The tops are pruned to increase the branches. They yield in seven or eight months, and the crops improve for two or three years, and every four or five years the plants are renewed. The blossoms, a double calix exteriorly, three cleft, appear in July and August, the pods opening in a few weeks, and the first crop being picked in November and December. The rainy season then produces a second crop, picked in March and April. The pods are then dried in the sun till the seed becomes hard, and the seed is then separated from the cotton by a gin. It is then picked and packed for market. Its great enemy is the caterpillar, called the chenille. An acre of cotton-trees, under favourable circumstances, yields 400 lbs. of cotton. The pods are the size of small apples, and filled with cotton, surrounding the seeds.

The cotton-tree flourishes in Arabia, Egypt, and India, and is 15 or 20 feet high. Another species grows in the Mauritius, and a third in China, of the colour of the nankeen made from it.

The shrubby cotton flourishes in Georgia, and is 5 or 6 feet high, known as *Sea Island.* It endures 5 or 6 years, and an acre yields from 150 to 250 lbs. The cotton and seeds are taken from the husks on the trees, and 50 or 60 lbs. of the seeds are separated by a gin per day, or 8 or 900 lbs. by a steam-engine.

In Louisiana, the plants yield for market 1½ to 2 cwt. per acre.

The wild cotton-tree grows 100 feet, and 25 feet diameter at its base. Two thirds up it has no branches, but they there become a forest 160 feet over, and a world of insects, &c

The *Coffee-tree* is evergreen, and like the bay-tree 8 or 12 feet high, which flourishes in countries in which the thermometer does not fall below 55°. It travelled from Persia and Arabia to France, and thence to Martinique in 1732, whence it has been spread through the West Indies. It was first sold at Constantinople about 1550, and in London in 1650. The trees begin to bear at two years, and the ripe berries are procured by the Arabs, by shaking the trees over a cloth, each bushel yielding 10 lbs. of coffee for use. The berries are then dried and fermented, and the husks separated in a mill. The seeds are delicately roasted before ground. 140 millions of lbs. are now annually consumed in Europe. In Asia and Africa, owing to heat of climate, coffee is roasted, ground, boiled, and drank within an hour; and corn is ground, kneaded, and baked, in half an hour. The corn for the day is always ground by hand-mills, in the morning, by two women, and baking immediately follows.

The *Cinnamon-tree* is a species of laurel, and is a native of Ceylon. It grows to 20 or 30 feet, and its trunk and branches produce the bark.

The *Cow-tree* of South America grows in rocks. It has dry and withered leaves—its roots scarcely penetrate the stone, and it enjoys little rain, yet when pierced, and especially at sun-rise, it pours out streams of sweet and rich milk, with which the Indians crowd to fill their bowls, and make a nourishing repast.

The *Clove-tree* grows to 40 or 50 feet, bears at 20, and continues till 50; they yield from 5 to 30 lbs. per annum. This spice is cultivated chiefly at Amboyna, and three adjacent islands. When possessed by the English, the islands yielded about 120,000 lbs. per annum, which sold for £20,000. The same mercenary despotism on the part of the Dutch prevails here as at Banda.

Cork, whose specific gravity is 0·24 or ¼ that of water, is the bark of a tree called *quercus suber*, which flourishes in southern Europe and northern Asia. It falls from the tree at 12 or 15 years old; but for commerce they are stript for several years successively, and then allowed an interval of two or three years.

Cinnamon-trees, so abundant in Ceylon, yield cassia buds, or unripe fruits, cinnamon, the dried bark of the tree, and essential oil, at the rate of 2½ oz. to 80lb. of chips and niches, and is 20*s*. per oz.

The night-blowing cereus has a flower 8 inches over, of exquisite beauty. It begins to open in the evening, at midnight is in perfection, and in the morning disappears.

The *Date*, in all tropical countries, is one of the most common trees, and grows from 50 to 100 feet, affording food, clothing, &c. For 70 years, a tree yields from 250 lbs. to 400 lbs. of dates.

Every date-tree produces 3 or 4 clusters, weighing from 20 to 50 lbs. each. Our dried dates are very inferior to the fresh-gathered. The foliage is evergreen; it has no branches, and rises from 40 to 60 feet.

The Himalaya cedar, (Deodora) is the most indestructible of substances. It is firm in the oldest buildings in India.

New Zealand flax, which, it appears, will grow on the bogs of Ireland, has been adopted in the navy for sail-cloth, tarpaulins, ropes, &c. It had long been known in Ireland as the bog-lily.

New Zealand flax, the phormium tinax, has been cultivated in Devonshire, and the valleys of other countries.

There are 400 species of heaths, and four natives of this island. In the Highlands they are used in building, for beds, and as a substitute for malt liquor. They dye an orange-colour, with a mordaunt of alum.

The lace bark-tree yields a membrane of which caps, &c. have been made.

The *lotus* of the Egyptians is a species of nymphæa, or water lily, with a flower like a tulip, white or blue. The roots of the white are eaten.

There are 216 species of lichen: of which the *orchall* is purple or crimson dye; the *omphalodes*, paler, but more lasting; and *islandicus*, used as bread and in medicine.

The *Mahogany-tree* is a native of Cuba, Jamaica, &c., and grows from 60 to 100 feet high, with deep-green foliage, orange-coloured flowers, and fruit the size of a large egg. Mahogany was first imported and known in England in 1724. The present imports are 20,000 tons per annum. It is one of the most majestic trees, single blocks often weighing six or seven tons. The trees are cut in forests called *the bush*, by *gangs*, who open new roads to draw them to the water-side.

The mangostien, about the size of an apple filled with pulp, is the prime luxury of the Indian islands.

The *morus*, or mulberry-tree, has several species. The white feeds silk-worms in China, the leaves sheep, and the branches make fire-wood.

The myrica pennsylvanica yields fine wax, and there is a tallow-tree in China and the Mauritius.

The dry-rot is caused by the fungus merulius lachrymans, and other fungi are the blight and brand of corn.

The *Nutmeg-tree* bears fruit from 10 years old to 100; the leaves resemble the laurel; the flowers are white, two or three on a peduncle. The nutmeg proceeds from a reddish nob in the centre of the flower, but not more than one-third ripen. The fruit is the size of an apricot, pear-shaped. When ripe, it opens and displays the nutmeg in a black and shining shell, enclosed in net-work of scarlet mace. The shell is like that of a filbert; it is dried with care,

and when the nutmeg shakes in it, it is broken, and the nutmeg soaked in sea-water and lime to preserve it from insects. There are three sorts, the wall nutmeg, the royal, and the green. About 190,000 lbs. are exported and sold in Europe, and 50,000 are sold in India. Nutmegs are now raised at Penang, and in abundance at Bencoolen. The trees come into bearing in seven years, and the annual produce of a tree is 3 lbs. of nutmegs, and 1 of mace. There are eight varieties; and the trees are male and female, the latter only bearing fruit. In Great Britain, 60 000 lbs. of nutmegs and 4000 lbs. of mace are consumed.—*Curtis's Botan. Mag.*

Onions possess more nourishment than perhaps any other vegetable. A Highlander, with a few raw onions in his pocket, and a crust of bread or a bit of cake, can work or travel to an almost incredible extent, for two or three days together. In France, the *soup de l'onion* is now universally in use after all violent exertions.

The moss *Spagnum palustre* constitutes the *Peat* of Europe. It has the property of throwing up new shoots in its upper parts, while the lower are decaying. Time is believed to convert it to ignite by the action of water. 100 parts have above 60 of hydrogen and carbon. It covers a tenth of Ireland. An overturned tree lying on a damp soil soon forms a covering of peat moss—a number of them a peat bog. A wood and a storm will always form peat, and in time beds of coal. The iron and its oxide are supposed to be precipitated from the vegetables. On the sides of mountains, peat is 3 or 4 feet thick, but in vallies, &c. often 40 feet. In hotter climates, vegetables putrify, or are devoured by insects, but in colder ones they form peat. Trees are found standing in peat bogs.

There are 21 species of the pine: among which the cedar is the largest, and the wild, or Scotch, the most important, producing yellow deal, and trunks 60 or 80 feet high. The silver fir is not less valuable for its quick growth and vast size. The larch is another species of rapid growth.

There are sixty species of the pepper-tree.

Palms are the most useful productions of Ceylon. First the cocoa-nut, in universal use for food, drink, and the arts of life. The palmyra, nearly as valuable. The areca catechu, whose nuts, the betel and the chunan, are the universal luxury of Asiatics. A tree produces from 500 to 1000 nuts. The sago palm, whose pith, dried and granulated, is in use through Europe, is also prolific in sugar. The talipot is famous for its large leaves, which shelters 15 or 20 men, and its fruit. The jack produces fruit as large as a man's body, filled with delicious pulp, and with seeds as large as chesnuts, of which many dishes are made. A Cingalese family live at ease on the produce of a dozen cocoa-nut and three or four jack-trees.

The chique-chique PALM of the Amazons produces abundance of hemp for cordage, and is cheap; and South America contains 80 or 90 species of PALMS. The fruit is farinaceous, yellow, sweet, and highly nutritive. Each tree bears three clusters, with from 50 to 80 large nuts in each.

Linnæus thought that the countries of palms were the first abodes of our species, and that man is essentially palmiverous.

The *Pimento*, or all-spice, is a species of myrtle in the West Indies, which grows thirty feet high.

In the *pitcher plant* of New South Wales, there is a lid with a hinge, by which it opens and shuts. It is generally half open, and contains fluid, in which ants and flies get drowned. The pitcher is attached to the foot-stalk, and supposed to be the means of nutriment instead of the root.—*Curtis's Bot. Mag.*

The palo de vaca, or hya hya, 100 feet high, and 7 in diameter, yields a rich milk, which, in coffee, cannot be distinguished from cow's milk. It flows at sun-rise from incisions in the bark.

The species of the genus *Rosier*, either indigenous in France, or cultivated in gardens, amount to 79.

Species.	Varieties.
Rosier mousseux	18
—— de chien	20
—— des Alpes	21
—— de Francfort	30
—— thé	42
—— rubigineux	57
—— noisette	89
—— de Damas	117
—— cent feuilles	121
—— pimprenelle	123
—— blanc	125
—— de Bengal	254
—— de Provins	1215

The *Sugar-cane* is a tall reed. The soft parts are eaten by the negroes, and from the hard parts the juices are expressed, which, by boiling and evaporation, chrystallize as sugar. It was cultivated in China 2000 years ago. It travelled thence into Arabia and Egypt, and afterwards to Sicily, Spain, and the West Indies. The plant is from 12 to 20 feet high, and propagated by cuttings, renewed every four or five years. The canes are cut down close to the ground, and then pressed through cylinders in a mill. The juice is then boiled briskly, and every 5 gallons afford 6 lbs. of crystals of sugar, as the produce of 110 good canes. It is then put into casks, and the drainage is molasses, or the uncrystallized part. This, with the skimmings, is fermented and distilled for rum. The sugar plant is called the *saccharum officinarum.*

Skirret root, the sium sisarum, yields 18 per cent. of pure sugar, and flourishes in Great Britain.

The Otaheite and Mauritius sugar-cane is extensively cultivated in India, where its produce is four times that of the indigenous species. If the West Indies fail, the Eastern Islands, Bengal, &c. can supply all the world with sugar. In fact, the Saccharine prin-

ciple is so intimately blended with all vegetation, that modern art could supply the human race with sugar from beet, pumpkins, wheat, barley, &c. &c. independently of the labours of the cruelly-abused bee.

The people of Kebba collect the fruit of *shea*-trees, from which they prepare *the vegetable butter*. These trees grow naturally in the woods, and in very great abundance. They resemble the American oak: and the fruit, from which the butter is prepared, is like a Spanish olive. The kernel is enveloped in a sweet pulp, under a thin green rind; and the butter produced from it, besides the advantage of its keeping the whole year without salt, is whiter and firmer, and of a richer taste than any butter made from cows' milk.

The strawberry-tree flourishes near Killarney, with a trunk 3 feet in diameter.

The *Tcha*, or Tea-tree, flourishes best in a light soil: it is raised from seeds sown in spring and transplanted in rows three or four feet asunder. After three years the leaves are plucked, and the plants yield three years' crops and are then renewed. They resemble myrtles, and their flowers are like the wild white rose. In some provinces they grow six or seven feet high, and in others ten or twelve. They are often made use of for hedge-rows, and the leaves gathered for domestic use. The leaves at the extremities are the best, and in spring of bright green. When gathered, they are first steamed, and then placed on copper, iron, or earthen plates over fires, by which they are shrivelled and curled up. The black teas are then exposed to the sun. The leaves of some other shrubs are so like that they are often fraudulently mixed. The common sorts are sold in China at 4*d.* per pound, and the superior at 2*s.*—The additions in foreign countries arise from freight, profit, and government-duties, and the profits of the Chinese merchants is from 25 to 50 per cent.

Green teas are chiefly produced in the province of Kianguan; the difference is believed to arise from the black being dried on iron plates, and the green on copper plates. The *songlo* green teas are so called from a mountain of that name, on and round which the shrubs grow. *Haysuen*, or hyson, is sold at double the sanglo. Tchu-tcha or gun-powder tea is rolled up by the hand, and sold at treble the sanglo.

Black teas are grown chiefly in the province of Fo-kien. The Chinese prefer it to green tea, as a better stomachic; the commonest sort is called *bouy* or bohea. Congou or *coagfoo* is a finer kind, sold at double the price.—*Saot-chong* or souchong is the best kind and sold at treble. *Pekao* is another superior kind, but milder. The tender leaves of young plants are called *masticha*, or tea for the emperor.

The cultivation of Tea is not general throughout the Chinese empire; the northern parts are too cold, and the southern too warm. The plant is the growth of a region between the 30 and 23 degrees of latitude, called the tea-country, *Tok-yen*, *Ho-ping*, *An-koy*, &c. The trees are planted four or five feet asunder; and are not allowed to grow higher than it is convenient to pick the leaves. The gatherings take place from one to four times in each year, according to the age of the plant. It is the difference in the times of gathering, and manner of curing, which causes the distinction in appearance, qualities, and value. Those which are gathered earliest in the spring make the strongest and most valuable teas, such as pekoe, souchong, &c.; the inferior, such as congou, bohea, are of the latest gatherings; green or hyson can be made of any of the gatherings, by different drying. The first gathering of the leaves begins about the middle of April, and continues to the end of May; the second lasts from Midsummer to the end of July; the third during August and September.

The Chinese keep tea a year; generally in those jars which in Europe are used as chimney ornaments. They infuse it in boiling water, and drink it without milk or sugar. They frequently reduce it to fine powder, and put a tea-spoonful into a cup, fill it with boiling water, stir it, and drink it. The Japanese cultivate this shrub as well as the Chinese. The best tea drank in China is the *yu-tien*, consisting of the youngest buds of the tree.

The tea of Paraguay is called caa. It thrives best in marshes, and the gathering the leaves is an obnoxious and very unhealthy employment. It is, however, the common beverage, and deemed a good stomachic.

Tea was first introduced into Europe, about 1660, and sold at 60*s.* per pound, and hence coveted as a luxury; 45 millions of pounds are now used in the United Kingdom, and about 4 millions of pounds, or one-fifth, of sloe, liquorish, and ash-leaves, are alleged to be annually mixed with tea-leaves.

Captains Jenkins and Charlton, in 1835, determined that the tea plant is not only indigenous, but cultivated, prepared, and used in Assam, on the Boorampooter, all the way from Tadiga and Beesa to Yunnan, in China. Every 5 pounds of green leaves produce 1 of dried, and they pass seven times through the process.

The genuine tea plant is distinguished, from its likeness to the camellia, by the shape of the seed, that of the former being round, produced in three distinct cells, and the latter being oblong with broad and narrow ends. The true tea plant rises 12 or 15 feet. The leaves are serrate about 2 inches long, and 1 wide, and they are heated and rolled several times till reduced to a fifth of their green weight. The plants live from 10 to 20 years, and they are propagated by seed in beds, and transplanted when 4 or 5 inches high; so that when grown, they are 1½ yard asunder, and each bush is about 2 feet diameter. 12 plants produce 1 pound of tea. On the spot, the prepared leaves sell at 23 dollars per pecul, 133½ pounds. The dis-

covery being made, it is expected that Assam tea will become an object of great speculation, a company of Chinese cultivators, from Yunnan and Fahkin, being already employed.

All books in Cingalese, relative to the religion of Buddhoo, are written on the leaves of the *talipot*. The character is engraved upon them with a brass, or an iron style. Some of these books are 500 and 600 years old, and still very perfect. This leaf is also used in Ceylon as a mark of distinction and in making tents, large enough to hold a party of ten persons at table. One leaf affords sufficient shelter for seven or eight persons from rain.

The *Teasel*, used in raising the nap in woollen cloths, is the flower of the *dipsacus fullonum*, cultivated in clothing districts. They are fixed on a cylinder, and revolved against the cloth. They are chiefly grown on strong soils in Gloucestershire, &c. and are very important crops. They are sold in packs of 9 or 10,000, at 6*l*. or 7*l*., and a pack is used in 6 or 7 pieces.

The tillandria, a species of aloe, yields by tapping, from 1 to 2 quarts of pure water.

Tobacco was brought to Europe from Tabaca in St. Domingo, by a Spaniard, in 1559, and sent from Lisbon to Paris, by Nicot the French ambassador.—In Virginia, *Tobacco* is a very exhausting crop, and severe labour attends the operations. An acre yields about 1400 cwt. The United Kingdom imports of it 21¾ millions pounds, and only ⅔ds of a million from other countries. It is, however, grown everywhere, except in this revenue-ridden country, where the duty is eight or ten times the price of the article.

The upas-tree, the *antiaris toxicaria*, or poison-tree, grows in Java to the height of 100 feet, and 6 feet diameter. Its emanations affect some persons and not others, but none fatally. It yields a bitter light-coloured juice, from which poison is extracted. The same island also yields a parasite, whose resin is still more poisonous.

The parasitical vegetable which occasions the dry-rot in ships, is a gigantic leather-like fungus, called *xylostroma giganteum*, or oak-leather: and that which causes the dry-rot in houses is a parasite of fir, called *voletos lacrymans*. The fungus appears to grow on the timber, and extract its cohesive parts. Wet-rot has no fungus, but separates rather than decomposes the fibres of the wood. Dry-rot first appears in the sap-vessels of the alburnum, and on the surface beneath the bark. It is reticulated, but as it proceeds the meshes are filled up, and a leather-like fungus appears. Fermentation, as in the case of mushrooms, seems essential to the growth of fungi which accompany dry-rot, and hence live trees are not affected by the seeds of fungi, or they might be converted into mushrooms, and other fungi.

Size and Age of Trees, &c.

The Wallace oak, near Paisley, is full 700 years old. An oak in Dorsetshire, in 1755, was 68 feet round; 2 near Cranborne Lodge are 38 and 36 feet. A Polish oak, 40 feet round, had 600 circles.

There are yews from 10 to 20 feet diameter, whose age is from 1000 to 2000 years.

A lime in the Grisons is 51 feet round, and about 600 years old.

An elm in the Pays de Vaud is 18 feet diameter, and 360 years old.

Some olives, near Jerusalem, are 800 years old.

A dragon's-blood tree, in Teneriffe, was 48 feet round, and 1000 years old.

The banian, or *fecus Indica*, is a collection of trunks shooting downwards; and the *cubbeer burr*, near Baroach, has 350 main trunks, and 3000 small ones. It is believed to be 3000 years old.

A sweet chesnut on mount Etna is 200 feet round, 2 others are 72 and 64 feet.

The African baobab is the patriarch of living organizations. One specimen, by its circles, is estimated at 5700 years old, by Adamson and Humboldt. The trunk is but 12 or 15 feet to the branches, and often 75 feet round.

Cypresses are known to be 8 or 900 years old. They rise 120 feet, and are from 25 to 40 feet round. Strabo speaks of one in Persia, 2500 years old. One in Mexico 120 feet round, and De Candolle considers it older than Adamson's baobab.

The plane or button tree, or sycamore, runs from 50 to 150 feet round. They often become hollow and useful as habitations.

Pines in North America grow 160 and 180 feet high. Some on the Columbia are 230 feet, and 50 or 60 feet round. For 120 feet they have no branches. One of 300 feet high, had no limbs for 200 feet.

The mahogany is full grown in 200 years to a vast size. A single log has weighed 7 tons, and sold for 500 guineas.

Thistles in the Pampas are 10 feet high, and clover rises 4 or 5 feet. Marigolds and camomiles in North Africa grow to 4 or 5 feet.

The *fucus pyriferus* is 300 feet long.

The rhododendron grows to 30 ft. in India.

Curtis's Botanical Magazine, for 1828, describes a new genus, the *telfairia pedata* of the Mauritius, the fruit of which is an enormous berry, or pepo, from 18 to 26 inches long, and 6 or 8 across. It contains five cells, filled with fleshy pulp, in which 2 or 300 seeds are imbedded, the size of a kidney-bean, and of the quality of an almond, for oil, &c.

The gigantic flower Rafflesia was discovered in the interior of Sumatra. It is parasitical, growing on the *cissus angustifolius*. The whole plant consists of flower and root. The diameter of the flower is *three feet*, and some parts of the calyx or corolla are three-fourths of an inch in thickness.

The vine at Hampton Court surpasses any in Europe. It is the black Hamburgh species, and is 72 feet by 20. It has, in one season, produced 2272 bunches, weighing 18 cwt. It was planted in 1769, and the stem, in 1810, was 13 inches.

Of the gum-tree, in Van Dieman's Land, there are 100 different species, some of them 150 feet high, and 40 feet round. There are also 100 species of the leafless *acacia*, and these two kinds of trees chiefly compose the woods of the country. The eucalyptus, or gum-tree, grows to 180 feet high and 36 feet round.

The forests in watered tropical climates are formed of trees from 100 to 200 feet high, which grow to the water's edge of rivers, presenting a solid and impenetrable cliff of trunks 10 or 12 feet in diameter. The dragon-tree is in girth from 40 to 100 feet, and 50 or 60 high; and a misosa, in South America, is described, whose head was 600 feet round.

South American trees are often 22 feet in circumference. In such trees, 180 feet high, what a wonderful assemblage of cells and vessels preserving organic life in them for 1000 years!

The Damary oak, near Brentwood, was sixty-eight feet round, and seventeen feet above the ground; was twelve feet in diameter.

A chesnut-tree on Etna is 196 feet round close to the ground; and five of its branches resemble great trees.

A chesnut tree grew at Tamworth, which was fifty-two feet round; it was planted in the year 800; and in the reign of Stephen, in 1135, was a boundary, called the Great Chesnut Tree. In 1759 it bore nuts, which produced young trees.

Dry reeds, twenty feet high, cover tracts of hundreds of square miles in the Burmean territory.

An oak-tree in three years grows 2 feet 10½ inches. A larch 3 feet 7½ inches. An elm 8 feet 3 inches. A beech 1 foot 8 inches. A poplar 6 feet. A willow 9 feet 3 inches.

An elm is full-grown in 150 years, and it lives 5 or 600. Ash is full-grown in 100, and oak in 200.

The yew-trees at Fountain's Abbey are about 1200 years old. That at Crowhurst 1500. That at Fortingal above 2000. That at Braburn from 2500 to 3000.

The famous *ficus Indica* of the Nerbudda is believed to be 2500 years old.

Ivys reach 5 or 600 years. The larch the same. The lime 600 or 700 years. Cypresses not less. A chesnut in Gloucestershire is 900, and one at Sancerre 600 years. A plane-tree, near Constantinople, is 160 feet round, and is mentioned by Pliny. Two orange-trees at Rome, planted by St. Dominick and Thomas Aquinas, are from 500 to 600 years. De Candolle says there are oaks in France 1500 years old.

The tree of Chapultepec, in Mexico, is 118 feet round. The California pine is from 150 to 200 feet high, and from 20 to 60 in circumference.

A yew found in the bogs had 545 rings of annual growth, though its diameter was but 18 inches. There were 100 rings in an inch.

In Penan, the tootoman-tree grows to 115 feet before it branches, and is 37 feet in girth for 10 feet high.

There is a cedar at High Clare, 3½ feet in diameter, a yard from the ground.

The American aloe grows at Salcombe Bay, in Devonshire. In 1820, one was 27 feet high, and had, in September, 16,000 blossoms, then but 19 years old.

The largest pine ever grown in this kingdom was cut from the hot-house of Mr. Edwards, of Rheola. It weighed 14 pounds 12 ounces, was 12¼ inches high, and 26 inches round.

The large black Hamburgh vine, at Sell-wood Park, was brought from Sion Hill gardens, in 1810. About the fourth or fifth year, it nearly filled the house, which was lengthened. The present length is about 100 feet, breadth 14 feet; number of bunches on the vine 1200. Many of the bunches weigh upwards of 2 pounds.

The troolie leaves, used for roofs in Demerara, are 20 to 30 feet long and 2 or 3 broad. They spring directly from the root, and are very durable.

The largest tree in Mexico is near Oaxaco, and is 127 feet round and 120 high, with branches of 30 feet. The cypress of Montezuma is 41 feet round, and of majestic heighth.

The trunk of a walnut-tree, 12 feet in diameter, hollowed out, and furnished as a sitting-room, was lately imported from Lake Erie, and exhibited in London. The trunk was 80 feet high, without a branch, and the entire heighth 150 feet. The bark 12 inches thick, and the branches from three to four feet in diameter.

The old apple-tree was in existence, in 1820, at Woolstrope, from which Newton saw an apple fall in 1665.

The cedars of Lebanon are now reduced to a single grove of 7 ancient trees, and others of all sizes.

Terebinth-trees, the El-Elah of the Bible, live 1500 or 2000 years, but neglect has rendered them scarce in Syria.

Stringy bark-trees, 200 to 213 feet high, and from 28 to 55 feet round, are not uncommon at Van Dieman's Land. Sassafras, 140 feet high, and myrtles 30 feet.

Progression of Plants.

The only indigenous fruit of Britain were the sloe, currant, black-berry, straw-berry, cran-berry, elder-berry, hips, haws, acorns, hazel-nuts, and beech-mast. Carrots, celery, beet, sea-kale, and mushrooms were our primitive vegetables.

In the reign of Henry VIII. the London markets were supplied with vegetables from Holland and the Netherlands.

The Exotics, hardy and tender, introduced into England, are 11,970 species, 47 before Elizabeth, 533 in her reign; 964 in the 17th century, and the remainder since 1760.

Sallads, artichokes, carrots, and turnips, were first cultivated in England, about 1530. Cauliflowers in 1680. Hops and spinach in 1520. Pine-apples in 1696. Potatoes and tobacco in Ireland in 1603.

Sea-kale became edible about 1780.

The Saracens introduced the sugar-cane into the islands of the Mediterranean and Old Spain, where these plantations still flourish. Hence it was conveyed to the Canaries, and then to the West Indies.

The fig, vine, olive, and pomegranate, are the earliest noticed fruit-trees cultivated by mankind in the temperate zone.

Italy was supplied with the fig from Syria, the citron from Media, the peach and nectarine from Persia, the pomegranate from Africa, the apricot from Epirus, the apple, pear, and plum from Armenia, and the cherry from Pontus. From hence they have been spread over Europe;

The fig-tree, about	1548
Lavender	1568
Laurestina	1596
Different mulberries....1548, 1596,	1629
The larch	1629
Common laurel	1679
Weeping-willow	1692
The flowering-ash	1710

Roses came from Persia, and into Persia from India. They abound in the countries round the Caspian.

The potato was a native of Chili, but known in England at the Reformation, and its culinary preparation described by Gerarde.

Turnips were introduced into England from Hanover, in 1716.

The larch was first imported into England in 1735, and taken to Scotland in 1737. 1000 trees have been sold for 5000*l.*

The walnut and peach came from Persia. The vine and apricot from Armenia. The cherry, chesnut, fig, olive, and mulberry, from Asia Minor. The damask rose was brought in the Crusades from Damascus.

Henna is a plant much esteemed in Egypt, &c. for its yellow dye of the hair, skin, &c.

The vines in Syria produce bunches of 10 or 12 pounds, and 20 inches long with grapes like small plums. Fig-trees also give two or three crops. The sycamore is a wild fig-tree. The pomegranate is a fruit prized at Aleppo, and the carob or locust-tree has pods of seeds and pulp, the juice of which is used for preserves, &c.

Potatoes were introduced from England to the continent in the reign of George I. Into Switzerland about 1730, and into France between 1760 and the Revolution.

Sugar-cane, in Arabic, is *lukseb:* and sugar, *assakur;* hence, therefore, the commercial name.

Coffee was first used in Arabia about 1420, and was introduced at Cairo in 1530, at Constantinople in 1554, at Venice in 1615, at Paris 1644, and in London 1652. The Dutch introduced its cultivation at Batavia in 1669, the French at Martinico in 1727, and the English at Jamaica in 1728. It is indigenous in St. Domingo, Abyssinia, Zanguibar, and Guyana. In Yemen it grows 18 feet high.

Rye and wheat were indigenous in Tartary.

Wheat was first cultivated by Dagon, or Ahsieriates, in Phœnicia. Rye was a native of Candia, but now flourishes in Orkney, where its straw is made into bonnets.

The Jerusalem articboke is a native of Brazil. The common artichoke, cardoon, and liquorice-root, of Spain. Onions and beans are Egyptian and African. Endive and radishes are Chinese. Lettuce and cress from the Levant. Beet and hemp are American.

The vine was brought from Asia by the early Greeks, and flourished in France before Cæsar's invasion.

The nectarine is a variety of the peach, and the peach is derived from the almond.

The shaddock, citron, orange, and lemon, are improvements of wild lime.

Celery is derived from smallage.

Filberts, &c. are improvements of the hazel-nut.

The plum had its origin in the sloe.

The apple-tribe are varieties of the crab.

The small colewort is the origin of the cabbage, brocoli, and cauliflower.

Sea-kale and asparagus were insignificant marine plants.

By culture, the marine *brassica oleracea* is in our gardens, the cabbage, cauliflower, savoy, kale, brocoli, and turnip-cabbage.

The wild briar is the parent of the rose; the sloe of plums, peaches, apricots, and nectarines; the crab of apples of all kinds; and corn the improvement of grass.

An olive has been grafted on a juniper, a peach upon a myrtle, pears upon oaks, apples on planes, mulberries on figs, a rose on an orange, carnations on fennel, peaches on mulberries, and red and white grapes, with peaches and apricots on the same stem; for as all buds are distinct trees, and the stem furnishes nutriment, so any bud inserted uses the passive stock for its own support. All do not assort, and many decay.

Botanical Memoranda.

The first green incrustation on rocks and walls, called *Byssus*, a species of moss, leaves a thin stratum of earth for a second crop; and, in fine, for wall-plants. Lichens and mosses are the first vegetables that grow on rocks: and in long time create soil for others by their remains.

Linnæus considers trees as all root, and the trunk and branches as roots above-ground, and the roots as subterraneous stem.

Trees are aggregates of individuals or buds, each being, in effect, a distinct tree; and their aggregate roots are the fibres of the tree descending to the ground. Hence, branches with buds grow when planted. In the rhizophista, the roots are ærian.

The most active parts of an old tree are the layers next the bark.

Growth and much nourishment diminishes flowers, and rapid growth supercedes them.

Stigmata and stamens often become petals.

Bulbs are buds under-ground.

Plants in water grow, but die early; an oak in water lived 8 years.

In England, the following is the order in which plants flower in spring:—

In *January*, the black hellebore and sweet colt's-foot. In *February*, the crocus, the snow-drop, the polyanthus, and the hepatica and daisy. In *March*, the early violet, the primrose, the daffodil, the pile wort, and the red dead nettle. In *April*, the cowslip, the crowfoot, the harebell, the lady's smock, the wood-anemone, the dandelion, wood-sorrel, and the wild yellow tulip.

Field-plants flower as under, on the average of seasons:—

In *January*, grounsel, hazel, chick-weed, maiden hair, hart's tongue.

In *February*, shepherd's purse, daisy, lung-wort.

In *March*, green hellebore, golden saxifrage, fumitory, speedwell, heart's-ease, violet, lady's smock.

In *April*, ground ivy, dandelion, stitch-wort, blackthorn, buttercup, crowfoot, hare-bell, bugle, and globe-flower.

From this time till autumn all vegetation flowers. In October, November, and December, only the mosses and yew-trees; but many blow till Christmas.

The first flowers of the year, or in March, are the daphne mezereum, *thymeleæ*; fucus vesiculosus, helleborus fœtidus, *ranunculaceæ*; tussilago farfara, *compositæ tribe corymbifer*; viola odorata, *violaceæ*.

Snowdrop appears	Dec. 24	Feb. 10
Turnip flowers	Jan. 10	June 18
Wood-anemone blows	Mar. 16	Apr. 22
Hawthorn leaf	Feb. 11	Apr. 22
Hawthorn flowers	Apr. 13	June 2
Sycamore leaf	Feb. 22	May 4
Birch leaf	Feb. 21	May 4
Elm leaf	Mar. 4	May 6
Mountain-ash leaf	Mar. 5	May 2
Oak leaf	Mar. 31	May 20
Beech leaf	Apr. 5	May 10
Horse-chest-nut leaf	Mar. 10	May 2
Spanish-chestnut leaf	Mar. 28	May 12
Hornbeam leaf	Mar. 7	May 7
Ash leaf	Apr. 2	May 26
Lime leaf	Mar. 19	May 7
Maple leaf	Mar. 15	May 7

Flowers of one climate do not open at the same hour in others. Thus, an African plant which opens at 6, if removed to France will not open till 9, nor in Sweden till 10. Those which do not open in Africa till noon, do not open in Europe.

In charcoal, the microscope discriminates vessels, or tubes, of which there must be millions in a square inch. In a square inch of oak, or gourd, there are 12 millions of such tubes or cells. In stems of herbs the small bunches of vessels consist of from 100 to 500. Through these tubes the fluids ascend in spring, before the formation of buds and leaves; they are larger as they recede from the centre.

The pores in leaves are, per square inch, 13,000 in the vine, 64,000 in the ilex, and 160,000 in the hydrangia and syringa.

It is this minute structure which enables vegetables to secrete from dead matter those corpuscles which constitute the substance of all living matter, as a new order of subsistence in all the forms of organized being.

The comparative quantities of Produce on an Acre, in Pounds weight, during the Season, of certain Vegetables.

	Pounds per Acre.	Time Growing.
Mangel Wurzel	22,000	12 Months
Parsnips	11,200	9 do.
Cabbages	10,900	6 do.
Vetches (Green)	9,800	4 do.
Cinque-foil Grass	9,600	12 do.
Turnips	8,420	6 do.
Apples	8,000	12 do.
Potatoes	7,500	8 do.
Carrots	6,800	9 do.
Grass	7,000	12 do. with feed
Pears	5,000	12 Months
Hay	4,000	12 do. and feed
Onions	2,800	6 Months
Plums, Cherries, and other fruits	2,000	12 do.
Beans	2,000	8 do.
Peas	1,920	8 do.
Oats	1,810	8 do.
Barley	1,600	7 do.
Wheat	1,260	12 do.
Hops	448	12 do.

Every part of a tree and plant contains spiral vessels, except the bark and pith, and they seem to be the germs, or basis of all the tubes; and this may be the mode of raising the fluids, since the weight would be diminished by the inclined planes of the spirals. In fact, the tubes themselves are spirals or the cases for spirals. Cellular texture and these tubes make up the wood.

The wood of trees is annually formed by a single ring of vessels, which at first surround the pith, and in each following year a new ring of vessels is formed around the preceding; so that the timber consists of a series of annual rings, enclosed in each other. The outer one being whiter and more juicy, is called sap-wood or alburnum.

Leaves have their origin in the bark. Those near the root are called *radical*; higher on the stem, *cauline*; near the flower, *floral*. Leaves consist of the *petiole*, or stem; the *lamina*, an expansion of the skin of the petiole; and the *stipules*, rudimentary leaves and sometimes spines.

After the sap ceases to flow, the leaves supply moisture to the bark, till then quite dry, and, therefore, this is a descending circulation. The sap of the bark and that of the wood is different.

The pith is composed of cellular texture, filled with fluid or air. But its uses have no relation to the medullary system in animals. The wood is cellular texture, or the tubes fit to convey fluids in fasciculi from the root; more compact towards the centre, and more expanded towards the bark, which binds the whole, while it is itself sustained by the leaves.

The leaves of the *mimosa genus* collapse either by touch or in the night, or by cold;

and the foot-stalks are the most sensitive to touch. The species *scandens* spreads to a vast extent from tree to tree, and has pods eight feet long. The late experiments of Dutrochet led him to conclude that the *mimosa pudica* possesses the elements of a nervous system. All the motions are spontaneous, and depend on a nervous principle, which receives impressions externally.

The *hedysarum gyrans*, according to Linnæus, possesses, in its leaves and petioles, the power of loco-motion, seldom being quiescent; the different leaves all over the plant moving variously up and down, round about, &c.

Sexual plants have spiral vessels, and are asculares. Cryptogamia are cellulares.

Metals are absorbed or secreted by plants. Quinine and coffee contain copper. Oak, iron; and vines, pine, and fig, manganese.

The fragrance of the *carnation* led me (says Sir John Hill,) to enjoy it frequently and near; and while the sense of smelling was satiated with the powerful scent, the ear was constantly attacked by an extremely soft but agreeable murmuring sound. I distended the lower part of the flower, and placing it in a full light, could discover, by means of microscopes, troops of insects frisking and capering with wild jollity among the narrow pedestals that supported its leaves. I admired their elegant limbs, their velvet shoulders, their backs, vyeing with the empyreum blue, and their eyes.

Sir J. E. Smith, the botanist, would not pluck a flower for fear of giving pain; and others object, owing to multitudes of animalculæ which flourish in every flower.

Pinks enlarge watered by solution of nitre.

Katraan, a vegetable tar, obtained near Mocha and in Arabia, is the most powerful preservative against putrefaction yet discovered, and was the substance employed by the Egyptians in preserving mummies.

Turf is 30 feet deep in upper marshes, and it grows 30 inches in a century. In Hanover it grows 8 feet in 60 years.

In the apricot there is a pulpy part, an osseous part, and in the centre the kernel; and the pulp and the stone, or osseous part, consisting of cellular tissue. The seed is connected with the stone by an umbilical cord. Within the ovulum is an inner tunic filled with cellular tissue, and a small tube, the apex of which is the embryo.

The pulp of the pear is made up of very fine cellular tissue, every where furnished with vessels. In the centre are five cells, each containing two seeds, severally attached by an umbilical cord. Throughout the pulpy matter solid particles are dispersed, chiefly about the core, and they serve as centres to little knots of vessels, of which there are fifteen principal ones, and ten of them connected with the seeds.

Small quantities of tannin and acids hinder vegetation; but alkalies promote it.

A similitude has been established between feathers and prickles in their offices.

Vegetable butter is in general use in Africa, and is potted; also palm-oil.

The *wooden* sculptures and mummy cases in Egyptian tombs are found perfect, and only the metal parts decayed. The image of Diana of Ephesus, of ebony, was perfect, after seven destructions of her Temple. Foundation-piles are perfect after 1000 years.

The Bushy Labyrinth at Hampton-Court, called the Maize, is in imitation of one in Holland, but the largest and most intricate in Europe is that of Versailles. That at Hampton-Court stands on two acres of ground. There were ancient ones at Crete and in Egypt, built with walls.

Knight considers flowers as products of the pith, wood, and bark.

Flowers have different temperatures. When the Richardiere Œthiopica is 55, the rosa odorata is 56, and the amaryllis Johnson 56. When the kerria Japonica is 56, the anemone double red is 57·5, while the atmosphere is but 54°.

The fertility of the West India Islands has been greatly abated within memory— the crops being but half or a third, owing to exportation of produce without return of manure, and the diminution of rain from cutting down woods.

Henry VI. forbade the planting of hops, and Henry VIII. forbade the use of "hops and sulphur." Hops now occupy nearly 50,000 acres, and flavour and preserve the eight millions of barrels of beer brewed from 30 millions bushels of malt.

Flinders suggests the advantage of planting cocoa and other productive trees on all sand-banks, &c. for the relief of wrecks.

Cocoas, Bananas, and Mangroves, are the first trees of coral reefs; and pines, oaks, and chesnuts, soon rise on streams of lava.

In the Netherlands and Holland fruit-trees are not nailed to walls, but tied to rods, planted and fixed a short distance from the wall, with immense benefit.

In Armenia, castor-oil is used for lamps, and *palma christi* much cultivated.

Apples ripen in order: the juncating, the codlin, the margaret, the pearmain, the golden rennette, the russet, the nonpareil, the golden pippin. Those used for cyder are the red-streak, the royal wilding, white-sour, the John, the hanger, and the gennet.

Hops entwine to the left, and convolvulus to the right. Tendrils bend to the left and back again.

The herb-shops, in London, have 500 species on sale.

The Botanical and Horticultural Establishments, in England, of pre-eminent interest are that at Kew, a royal establishment, which contains specimens of all indigenous plants, and of many rare and other exotics, classed and arranged in fine order; the Horticultural Society's Garden, at Turnham Green, consisting of an arrangement of flowers and shrubs; the Horticultural and Botanical grounds of Curtis, of Glazenwood, between Coggeshall and Braintree, consisting of 50 acres of all the flowers and fruits which bear the English climate; Loddige's Nursery Grounds at Hackney, which claim notice for superb palms; the Duke of Nor-

thumberland's extensive and costly conservatory at Sion, in Middlesex. There are also well-supported establishments at Edinburgh, Chelsea, Manchester, Liverpool, Oxford, Cambridge, &c.

The *Jardin des Plantes*, at Paris, dates its origin from the 17th century; and, as a school of botany and vegetable culture, is the first establishment of the kind in Europe. Plants are brought from all countries, by universal correspondence, and by naturalists, sent out at the expence of the nation. Every warlike, exploring, or commercial expedition, is accompanied by naturalists, officially appointed or voluntarily admitted. Plants received in the Paris garden are propagated without loss of time, and distributed to all the botanic gardens of France, of which there is at least one in every department.

Roxburgh's Indian Flora proves that every part of India has been explored by botanists under the patronage of the Company. Their Garden, at Calcutta, employs 300 persons in naturalizing plants of other countries, and in cultivating rare oriental ones, under the enlightened management of Dr. Wallich.

There is no circulating system in plants, only an ascending and descending current.

The epidendron, flos æris, or Chinese air-plant, lives in and on air; flowers, and gives out fragrance without any root.

The orchis latafolio appears to walk by the oscillation of two bulbs.

Male and female plants, as in turnips and spinach, are to each other from 700 or 900 to 1000.

Plants are mature for propagation as they are well or ill-nourished, and this appears to hold in animals, and the human species.

In the West Indies the bread-fruit tree, transported from the South-sea Islands, has been attended with no success.

Many plants close on the approach of rain.

Wheat and barley-straw melts into glass before the blow-pipe; and bamboo is converted into the highly-refractory tabasheer crystal. The equisetum contains so much silica as to abrade brass.

Twelve yards square of Banana plants yield 4000 pounds of fruit, while the same area of wheat would be but 33 pounds, and of potatoes 100 pounds.

The blossoms of heaths cover moors, the blue gentians the mountains in Switzerland, poppies confer redness on fields of grain, the beard of cotton grass whitens marshes, and the blossoms of cardamine bleaches pastures.

The sea-side sedge, the sea lyme-grass, and the sea-reed or arundi arenaria flourish on sandy shores and bind by their roots.

The oak supports hundreds of species of insects, besides ferns, lichens, mosses, &c., and affording apples, gall nuts, acorns, &c.

Part of the interior of the white mulberry is composed of a tissue of beautiful white fibres of silk, much resembling China silk, which leads to the inference that silk is a vegetable, not an animal product, that is to say, that the basis of the material, in its proximate form, is derived from the vegetable kingdom, though the spinning of its substance into a lengthened thread is entirely due to the mechanical functions of the silk-worm. Black produces the best fruit. The bark of the *papyrifera* species is employed in Japan to make paper, and it also makes fine white cloth.

It was the *misletoe*, parasite of the oak, which the Druids reverenced. Similar superstitions prevailed in Greece.

Grape-wine used to be produced in England, and might still be produced, if the vines were pollards, or trained near the ground as in France.

The leaves of the *hawthorn* are an excellent substitute for Chinese tea.

The cypress flourishes in gigantic size when its roots are six months under water.

Fairy rings are ascribed to expanding fungi, which in a circle of enlarged dimensions exhaust themselves.

Cuba has a scented climbing-plant whose leaves are as hard as wood.

Eighty existing plants are depicted on Egyptian monuments, and many have been found in mummies.

New walls and roofs are covered by the *gymnostomium ovatum*, and the *lanceolata*.

The three great oceans present vast extents or banks of sea-weeds, often like meadows. They prevail west of the Azores, between lat 25° and 36°.

Black lead pencil-cases are made from the wood of a juniper-tree.

The culture of coffee is now preferred to the vine in Madeira.

In the generation of mushrooms by composts, only one species appears, the *agaricus campestres*, and the sporules of these are infinite in number and minute in bulk.

When trees are felled in the lofty forests of the Alps, they are then conveyed to the water by slides. The slide of Alpnach, on Mount Pilatus, is above eight miles long, and consists of 25,000 trees, stript of their bark, laid at an inclination of 10° to 18°. The trees run down it in six minutes.

Tournefort mentions that, in Provence, the maturation of figs is hastened by pricking them at the open end with a straw dipped in olive oil. A similar practice prevails in Syria.

The down of thistles was spun by the ancients to make acanthine garments.

Red snow is coloured by a fungus, the protococcus nivalis.

The truffle grows under-ground.

Fungi grow on all animal matters.

Paper, and, in damp places, glass, generate peculiar conferva. Also, wine-casks, goulard-water, &c.

Salt and glass-worts grow near salt-pans.

Algæ, fuci, ulvæ, &c. grow in the sea.

The flowers of aquatic plants fructify at the surface only.

Docks, nettles, &c. sustained by animal substances, always follow man

A fungus in mines yields light

Orchideæ, or air-plants, have no roots, and derive support from air.

New Holland produces acacia without leaves, and large petioles in place.

Potatoes grow at Quito 10,000 feet above the sea; but olives not above 1250 feet.

Wheat grows to the heighth of 1000 feet, and oats and potatoes to 2000, in England.

Barley has 2, 4, or 6 ranks. The Scotch call the 4 Bigg; and the 6, Barley Bigg.

Within the tropics few trees are ever divested of their foliage. In the Mediterranean region about 300 retain their leaves; the middle temperate zone has 40, the northern 24, and the arctic but 8 or 9.

Hot-houses are now most advantageously heated by hot-water, a plan first adopted by Marsland, of Stockport, by which he supplied London tables with pines and grapes.

Indian arrows are poisoned by the milky juice of manchineel, of the euphorbian genus.

Rhodium is the scented wood of the Chinese rose-tree. Yellow saunders is another eastern scented wood. Cassia lignum is a scented bark from Ceylon. Cinnamon bark is well known for its fine scent. Clove bark is another of these scented vegetables.

Poisonous plants have the fruit a berry, the flower a single petal, and the fructification of five stamens and one pistillum.

Vines of the most delicious kinds are indigenous on the Arkansas.

Dr. Charles Hutton, who hated superstition in every form, asserts that in his presence, and that of other persons, a lady detected a spring of water by the bending downward of a *hazel-twig*.

Dutch gardens were straight walks with clipt hedges of yew, holly, or box. Kent, Phillips, Brown, and Repton were the fathers of the open English garden system.

The taste for flowers proceeded from China and Persia 2 or 3 centuries since. The flower trade in Holland was memorable. Haarlem was the centre of it. In 1636 and 1637, the tulip mania prevailed in Holland. Bulbs, which the seller did not possess, were sold at enormous prices, on condition that they should be delivered at a given time. 13,000 florins were paid for a single *semper-Augustus*; for three of them together, 30,000 florins; for 148 grains weight, 4500 florins; for 296 grains of *admiral-Liefkenshoek*, more than 4000 florins; for *admiral Enkhuizen*, more than 5000, &c. For a *Viceroy*, on one occasion, was paid 4 tons of wheat, 8 tons of rye, 4 fat oxen, 8 pigs, 12 sheep, 2 hogsheads of wine, 4 barrels of beer, 2 barrels of butter, 1000 pounds of cheese, a bundle of clothes, and a silver pitcher. At an auction in Alcmaer, some bulbs were sold for more than 90,000 florins. An individual in Amsterdam gained more than 68,000 florins, by this trade, in four months. In one city of Holland, it is said, more than 10,000,000 tulip bulbs were sold. But when, on account of the purchasers refusing to pay the sums agreed upon, the states-general (April 27, 1637) ordered that such sums should be exacted, like other debts, in the common way, the extravagant prices fell at once, and a *Semper-Augustus* could be had for 50 florins. Even at present, 25 to 150 florins is the price of a single rare tulip, in the catalogues of florists Haarlem still continues to be the emporium. Hyacinths first began to rise in estimation in 1730. In that year 1850 florins were paid for *passe-non-plus-ultra*, and in the same proportion for others. Between Alcmaer and Leyden there are more than 20 acres of land appropriated to hyacinths alone, which thrive best in a loose and sandy soil. 12 or 13 great florists in and around Haarlem, send their flowers to Germany, Russia, England, &c., and even to Turkey, the Cape, &c.

The dendrometer is an instrument for taking the exact contents of standing trees.

To obtain the figure of a plant, rub a piece of paper with powdered dragon's blood, in the manner practised by engravers, and then the small branch or leaf, of which the design is required, is to be laid upon it; by means of slight friction, it soon takes up a small quantity of the powder, and moistened paper, an impression is taken.

In France, vines grow like raspberry-bushes; in England, they are trained high against a wall; and, in Savoy, they are trained around the trunks of decayed trees.

An acre of ground will contain 43,560 plants, at 12 inches apart; 19,360, at 18 inches; 10,890, at 2 feet; and, of course, 4,840 a yard asunder; 2,722, at 4 feet; at 10 feet but 435, and at 20 feet but 108.

Vegetable life being a process of chemistry, and its products exhibiting every variety of elemental combination, so as animal diseases are chiefly elemental disturbances these are corrected by vegetable preparations. The *materia medica* consists, therefore, almost entirely of vegetable products, with a few earths and some metals.

Peruvian and cascarilla *Bark*, and camomile flowers, are powerful tonics.

The *Bitter* principle prevails in quassia, gentian, hops, camomile, and some others; it has been made by chemists as quinine.

Starch, the product of tuberose roots and grain-like vegetables, is a white insipid powder, which with boiling-water forms nutritious jelly, and in various forms is the basis of most animal food. Treated with water and a 50th of sulphuric acid it forms sugar, or with dry gluten it gives half sugar. It is, in fact, part sugar and part other matter. Potato-starch consists of 43·48 carbon, 49·45 oxygen, and 7·06 hydrogen, and 1¼ pounds give 1¼ sugar, which is 44 carbon, 49 oxygen, and 7 hydrogen.

Oils are the product, by pressure, of the seed of nearly 100 trees or shrubs; olive-oil is 77·2 carbon, 9·4 oxygen, 13·4 hydrogen.

Alcohol, in every form, is derived from the fermentation of vegetable products. It is 43·65 carbon, 37·85 oxygen, 14·94 hydrogen, and 3·52 nitrogen. The preparations are fully described in the Author's volume of *The Arts of Life*.

The saccharine principle is found in all vegetables that contain starch, but chiefly in the sugar-cane, maple, beet, potato, carrot.

Cathartics are rhubarb, jalap, pulp of

cassia, bitter apple, aloes, senna, oil of croton-seeds, castor-seeds, &c.

Diuretics are squills, fox-glove, dandelion, wild carrot seeds, parsley-root, buchu.

Farina, or meal, is made from grain, and its nutriment depends on the starch.

Gum is pure mucilage, and the juices, when matured, are sweet, oily, and farinaceous. *Gum Arabic* is obtained from a species of mimosa, called *nilotica*. *Gum* tragacanth is a native of Crete, and more adhesive than gum arabic.

Aromatics in general use are cinnamon, nutmeg, cloves, orange, and lemon-peel, pepper, pepper-mint, spear-mint, cardamom, carraway, anise, coriander, ginger, dill and cummin-seeds.

Sanatives are opium, nightshade, lettuces, poppy-heads, colchicum, henbane, hemlock, stramonium, and tobacco.

Stimulants are the aromatics, mustard-seed, euphorbium, and fox-glove for the kidneys, and ergot of rye for the uterus.

The *Narcotic* principle in the white poppy produces opium, which is its concrete juice.

Amber is the product of a tree now extinct, or an exudation from the roots, by which it entangled insects, &c.

Assafœtida is the root of a Persian plant.

Areca-nut makes tooth-powder.

Argol, or archel, is a mordant substance obtained from lichens, and used by dyers to improve and fix colours.

Arnatto is a dye, prepared from reeds.

Arrack is made from the juice of the tops of cocoa-nut and palmyra-trees; also from *paddee*, rice in the husk.

Balm of Gilead, or balsam of Mecca, is made from the resin which exudes from incision in the bark of a plant belonging to the genus amyris, which grows near Mecca.

The *balsams* of Tolu and Peru are made from resins which exude from S. American plants. *Balsam of Peru*, from *peruiferum*.

The *Betel*, or pawn, chewed in the East by both sexes, like tobacco, consists of the fruit of the areca palm, wrapt in leaves of the betel pepper-plant.

The *Belladona*, or deadly night-shade, produces berries like black cherries.

Bird-lime is prepared from the berries of the misletoe and the bark of the holly.

Catechu is the boiled heart or leaves of a tree or shrub which flourishes in the Burman empire, and in Concan on the Malabar coast. It is an inspissated tan, and the most powerful known astringent, 1 pound being equal in tanning to 7 or 8 pounds of oak bark.

Caoutchouc, or Indian Rubber, is formed of a gum which exudes by incision from two plants which grow in Cayenne and the Brazils, called *hævia caoutchouc*, and the *jatiopha elastica*; the resinous substance, as it hardens, is formed round clay moulds.

Cudbear grows on rocks, and is used in dyeing purple.

Dragon's Blood is the product of large rattans of Sumatra.

Frankincense is the gum of the *libanus thcorifera*, also called *olibanum*.

Gall-nuts are protuberances on trees, created by the puncture of insects, and gallic acid is made from those on the oak.

Gamboge is a concrete juice, and produced from two trees called *caracapulli*, which grow in Cambodja.

Storax is a *gum* used in honey-water, &c.; *gum* Benjamin is another gum, labdanum another.

Litmus is made from the archil lichen. Acids turn its purple to red, and alkalies the red into blue.

Lichen, or liver-wort, yields mucilage, and makes a strong jelly when boiled in water or milk.

Liquorice is the extract of the juice of a root cultivated at Pontefract, where it is made into pectoral cakes, and also in Spain and the Levant.

The flashes of torches used on the stage are made by the fine dust or seeds of *Lycopodium*, or club-moss.

Madder is the root of the *rubia tinctorum* which grows in Europe. It gives a deep red dye, changed by alkalies, &c. into crimson and orange.

Manna is a natural product of the ash and larch, in Sicily, Calabria, &c.

Molasses is the syrup of the cane, which does not crystallize, corresponding with the water of crystallization.

Myrrh is a gum-resin.

The *Nux vomica*, or poison-nut, is imported in large quantities.

Opium is the juice of the white poppy.

Otto of Roses is the oil which swims at top in the distillation of rose-water.

Pitch is inspissated tar, drawn chiefly from pines, and from ruins of their ancient forests, in the coal distilled from gas.

Pyroligneous acid, or condensed steam of green-wood baked in an oven, is a most powerful antiseptic; and the smoke of wood-fires and charcoal is the same.

Quercitron is the inner bark of the Quercus Niger, or Oak, and it produces yellow dye. Oak saw-dust produces drabs and shades of brown. Oak-apples are a substitute for galls.

Raisins are perfectly ripe grapes, dried in the sun, or in ovens.

Sarsaparilla is the root of a Peruvian plant called *smilax*.

Sassafras is wood of the laurel kind.

Salop is made from the root of the orchis.

Sycamore wood makes bowls.

Soy is made from the beans of the *dolichos soja*, a native of Japan.

Terra japonica is mimosa catechu.

Tapioca is the powder of the *jatropha manihot*. The juice is poison, but the fibres and seed make casava bread, and tapioca.

Turmeric is the root of the *curcuma longa*. Paper stained with it becomes brown by alkalies.

The green colour of vegetables arises from the fixation of the nitrogen of the atmosphere on the surface by the action of light and the solar rays.

Fir contracts in width one 124th, and oak one 140th, by changes in the atmosphere.

Northern India has a flora of 3500 phœnogamous plants.

An acorn in 24 years becomes an oak 19 inches in girth at 5 feet high: in 41 years 32½ girth, and 117 years 13 feet girth, and 64 feet high.

In 75 years an oak contains a ton of timber; in 150 years 8 tons; but the poplar increases three times faster than the oak. So in 13 years, while the oak increased 4½ inches in girth, the larch increased 33 inches.

Longevity of Plants.

The list is an approximation merely, furnished by the high authority of Mr. Don, Secretary and Librarian of the Linnæan Society.

	Years.
The Boabab tree of Senegal, *(adansonia digitata)*	5150
Deciduous Cypress *(Taxodium distichum)*	6000
Quercus Robur *(Oak)*	1600
Pinus Cedrus *(Cedar of Lebanon)*	800
Ash *(Fraxinus excelsior)*	400
Ivy *(Hedera Helix)*	600
Larch *(Pinus Larix)*	270
Lime-tree *(Filia Europæa)*	583
Spanish Chestnut *(Castanea vesca)*	700
Yew *(Taxus baccata)*	3000
Juniper *(Juniperus communis)*	380
Olive *(Olea Europæa)*	2500
Oriental Plane *(Platanus orientalis)*	1200
Orange *(Citrus Aurantium)*	1500
Pear-tree	260
Apple-tree	from 80 to 175
Scotch Fir *(Pinus sylvestus)*	90 to 120
Balm of Gilead Fir *(Pinus balsamea)*	30 to 50
Pinaster *(Pinus Pinaster)*	80 to 100

The following are Monocotyledonous or Endogenous trees, viz.—

Date Palm *(Phœnix dactylifera)*	200 to 300
Cocoa Nut Palm *(Cocos nucifera)*	330
Brazil Cabbage Palm *(Cocos oleracea)*	600 to 700
Showy Brazil Palm *(Gulielma speciosa)*	300
Brazil Vine Palm *(Œnocarpus Batana)*	150
Dragon's-blood Tree *(Dracena Draco)*	4000

This last is by far the longest lived of the monocotyledonous class. It might be supposed that complexity of structure was unfavourable to longevity, but in reality the longest lived are those beings endowed with the highest organization, as man among animals, or, *Adansonia* and *Taxodium* among vegetables; while the simplest forms in both kingdoms are the shortest lived, as *Fungi* and *Algæ* and polypes and infusoria among animals.

THE MINERAL KINGDOM.

The external shell, or crust, of the globe, consists of atoms combined by the action of air, water, heat, electrical action, and weight. Sometimes in grains pressed into masses; at other times of grains cemented by the exudation and filtration of the finely-divided atoms of superior strata; sometimes of masses chrystallized by evaporation; and often of ores which separate into metals.

The Crust of the earth may be compared to a great compost in chemical fermentation, subjected to the excitements of heat and light; to the varied actions and reactions of the elements; to the central force of weight; and to the motions which cause weight. It is only in this enlarged sense that we can correctly examine the singular results.

This fermentation, or incessant composition and decomposition, has operated on all the parts, or surfaces, which in countless revolutions have been exposed to the Solar action, to an atmosphere of oxygen and nitrogen, and to water of hydrogen and oxygen, with muriatic acid. We find the primitive earth only when we descend below the conglomerate of what has been surface, at the mean depth of 1 or 2 miles.

Fossil remains of organized beings are the subject of geology, but the same processes which have fossilized them, also, so to speak, have fossilized earths themselves; consequently, few subjects are in their primitive state, but in intimately mingled states.

The Study of Mineralogy is the study of the use and value of the country which man inhabits. Of all sciences and arts, those of Mineralogy, Agriculture, and Gardening, stand foremost. Geology is the theory of Mineralogy, and the natural history of the globe. It divides itself into earthy or rocky formations, stones, gems, and metals.

The best systems of minerals are those of Berzelius, and the chemical arrangement of Mohs. Naumann unites them.

Buckland's Order of the Strata.

Granite.	Coal formations.
Gneiss.	Red conglomerate.
Mica slate.	Magnesian lime-st.
Primary lime-stone.	Variegated ditto.
Chlorite slate.	Shell ditto.
Hornblende slate.	Variegated marl.
Clay slate.	Lias.
Quartz rock.	Oolitic formations.
Transition conglomerates.	Purbeck Wealdon.
	Green sand.
Quartz rock.	Chalk.
Grauwacke slate.	4 Fresh-water.
Transition lime-stone.	4 Marine formations.
Shale & sand-stone.	Diluvium.
Old red sand-stone.	Alluvium.
Mountain lime-stone.	

Other Series.

Trap.	Lavas.

Werner ranges the *primitive* rocks:—

1. Granite.	11. Quartz rock.
2. Gneiss.	12. Prim. flinty slate.
3. Mica slate.	13. Prim. gypsum.
4. Clay slate.	14. White stone.
5. Prim. lime-stone.	15. Clay porphyry.
6. Prim. trap.	16. Pearl stone do.
7. Serpentine.	17. Obsidian do.
8. Porphyry.	18. Trans. sienite.
9. Transition sienite.	19. Pitch stone.
10. Topaz rock.	

The transition rocks—
1. Lime-stone. 3. Gneiss-wacke.
2. Trap. 4. Flinty slate.

The Classification of MOHS, now so generally preferred, is as follows:—

CLASS I.

ORDER 1.—*Gas.*

Genera. 1. Hydrogen. 2. Atmospheric air.

ORDER 2.—*Water.*

Genus. 1. Rain-water.

ORDER 3.—*Acid.*

Genera. 1. Carbonic acid. 2. Muriatic acid. 3. Sulphuric acid. 4. Boracic acid. 5. Arsenic acid.

ORDER 4.—*Salt.*

Genera. 1. Natron salt. 2. Glauber salt. 3. Nitre salt. 4. Rock salt. 5. Ammoniac salt. 6. Vitriol salt. 7. Epsom salt. 8. Alum salt. 9. Borax salt. 10. Brythine salt.

CLASS II.

ORDER 1.—*Haloide.*

Genera. 1. Gypsum haloide. 2. Cryone haloide. 3. Alum haloide. 4. Fluor haloide. 5. Calc haloide.

ORDER 2.—*Baryte.*

Genera. 1. Parachrose baryte. 2. Zinc baryte. 3. Scheelium baryte. 4. Hal baryte. 5. Lead baryte.

ORDER 3.—*Kerate.*

Genus. 1. Pearl kerate.

ORDER 4.—*Malachite.*

Genera. 1. Staphyline malachite. 2. Lirocone malachite. 3. Olive malachite. 4. Azure malachite. 5. Emerald malachite. 6. Habroneme malachite.

ORDER 5.—*Mica.*

Genera. 1. Euchlore mica. 2. Cobalt mica. 3. Iron mica. 4. Graphite mica. 5. Talc mica. 6. Pearl mica.

ORDER 6.—*Spar.*

Genera. 1. Schiller spar. 2. Disthene spar. 3. Triphane spar. 4. Dystome spar. 5. Kouphone spar. 6. Petaline spar. 7. Feld spar. 8. Augite spar. 9. Azure spar.

ORDER 7.—*Gem.*

Genera. 1. Andalusite. 2. Corundum. 3. Diamond. 4. Topaz. 5. Emerald. 6. Quartz. 7. Aximite. 8. Chrysolite. 9. Boracite. 10. Tourmaline. 11. Garnet. 12. Zircon. 13. Gadolinite.

ORDER 8.—*Ore.*

Genera. 1. Titanium ore. 2. Zinc ore. 3. Copper ore. 4. Tin ore. 5. Scheelium ore. 6. Tantalum ore. 7. Uranium ore. 8. Cerium ore. 9. Chrome ore. 10. Iron ore. 11. Manganese ore.

ORDER 9.—*Metal.*

Genera. 1. Arsenic. 2. Tellurium. 3. Antimony. 4. Bismuth. 5. Mercury. 6. Silver. 7. Gold. 8. Platina. 9. Iron. 10. Copper.

ORDER 10.—*Pyrites.*

Genera. 1. Nickel pyrites. 2. Arsenic pyrites. 3. Cobalt pyrites. 4. Iron pyrites. 5. Copper pyrites.

ORDER 11.—*Glance.*

Genera. 1. Copper glance. 2. Silver glance. 3. Lead glance. 4. Tellurium glance. 5. Molybdenum glance. 6. Bismuth glance. 7. Antimony glance. 8. Melane glance.

ORDER 12.—*Blende.*

Genera. 1. Glance blende. 2. Garnet blende. 3. Purple blende. 4. Ruby blende.

ORDER 13.—*Sulphur.*

Genus. 1. Sulphur.

CLASS III.

ORDER 1.—*Resin.*

Genus. 1. Melichrone resin.

ORDER 2.—*Coal.*

Genus. 1. Mineral coal.

The experiments of Crosse and Becquerel, and the observations of Fox and others, leave no doubt (as suggested by the Editor in former editions) that crystals and metallic ores are immediate products of electrical action between those plates of rocks, which are the sides of fissures and veins. Iron, as coeval with the primitive rocks, has its peculiar laminated and magnetic characters; and it may also be generated in rocks, like infiltrated sparry fibres, which, when in open recesses, appear as stalactites. This inference is, however, derived from a rational theory of electricity which ascribes it to the separation of oxygen and hydrogen, and its forces to the re-union of the same elements. The walls of veins, &c. are plates in correllative action; and the aura of different rocks, carried from side to side, would in time, and at rest, generate filaments, fibres, and all the novel materials of ores.

Rocky substances in general are, beyond question, results of those attritions, separations, re-mixtures, deposits, infiltrations, crystallizations, &c. which would result from the centrifugal force of the mobile waters in perihelion, depending on the varying declination of the perihelion, as North or South in every 10,450 years. Tidal action rising over the highest hills, storms, currents, &c. would dislocate, decompose and recompose in all the varieties of formation which we witness. In other words, the waters following the greater force in the perihelion, as a physical centrifugal force, would change all things moveable and changeable; and produce all the compound bodies and masses that, under the name of Mineral, compose the crust of the Earth.

[Both these theories, due to the Editor, are to be regarded as indisputable facts.]

No guess can be formed of the materials of which the Earth is composed below the primitive rocks. But these are supposed to have been once fluid, and in cooling or otherwise, presented an unequal hard surface. The abradings by the elements then produced detritus which filled up the hollows and valleys, leaving the nodes and asperities uncovered as mountains. Hence the lowest are also the highest, and their decompositions cover their sides, as strata.

The *primitive* rocks are chemical formations of silica, alumina, and magnesia, and are of 19 kinds. The *transition* are of four or five kinds, and partly chemical, partly mechanical, with petrifactions of Zoophytes. The *secondary*, above these, are of twelve

kinds, abounding in vegetable and animal petrifactions. The upper strata have been formed by water from submersions of the sea, rain, and rivers, and abradings of these are called alluvial.

The greater solidification of lower strata arises from the precipitation and infiltration of cements, from overlying strata, which often changes original characters, densities, colours, &c. Heat, too, has its share in effecting many changes, and this with pressure of superincumbent rocks, and overlying water, during thousands (or millions) of years, as Buckland imagines, removes all surprise at the compactness of the hardest rocks of primary grauwacke from sand, and of primary slates from clay.

The Crystalline rocks are the granitic series of quartz, felspar, mica, gneiss, sienite, porphyry, green-stone, basalt, and compact lavas, all in varieties.

Quartz, felspar, mica in grains or imperfect crystals are granite; in scales are gneiss.

Immediately above granite lies gneiss, then mica slate, and above that clay slate. Mingled with these last is primary limestone, trap, and serpentine.

Quartz is the basis of all the silicious compounds in nature, and is distinguished by the hardness of the bodies, as crystals, gritty sand, &c. It cannot be cut with a knife, and strikes fire with steel. It is 96 or 97 silex in 100, and 3 or 2 clay and lime.

Felspar is white, red, or grey, and consists of 64 in 100 parts of silex, 19 of alumine (clay,) 2 lime, 13 potash, and 1 oxide of iron.

Felspar is composed of lamina or plates. Its constituents are silex and alumina, with some potash. It abounds in granite, gneiss, sienite, and porphyry. When large crystals of felspar appear in granites, they are called porphyritic. In Cornish granites, the felspar is white. In the Scotch, reddish brown. Felspar, next to quartz, is the most abundant stone, being a constituent of granite and other rocks. It scratches glass, and gives out sparks with steel.

Felspar is of vitrified character, but of different colours, and, when broken down, forms the basis of clay.

Mica, the other equal part of granite, is 47 silex, 22 clay, 14·5 potash. 15 oxide of iron, and 1·75 oxide of manganese.

Mica is found in such large plates, in many mountains, as to be used as a substitute for glass, being semi-transparent, tough, flexible, and elastic. In Siberia, some specimens are 2¼ yards square.

Mica is a dark grey, often decomposed by the atmosphere, and, when worn down, it mixes with the clay of the felspar, or the sand of the quartz.

Various proportions and circumstances render the three the bases of all secondary rocks, which appear to be their ruins

Therefore 300 parts of granite consists of 207 silex, 43 of clay, 4 of lime, 27·5 of potash, 16 of oxide of iron, and 1·75 of oxide of manganese.

Silex consists in 100 parts of 52 of oxygen; *clay* of 46 oxygen; *lime* of 28 oxygen; potash of 17 oxygen, and the oxides of about 30 oxygen; hence, 138 parts of 300 granite are oxygen, and 161 other substances.

Carbonate of lime, now one-eighth of the crust of the globe, contains 56 parts in 100 of oxygen

Nitrogen is 78 parts in 100 of the atmosphere, and hydrogen 12 of 100 parts of water. The atmosphere is, therefore, a further magazine of a fifth oxygen, and water an eighth.

The rocks most abundant are the silicious; the next the argillaceous or clayey; the next the calcareous, lime and magnesia.

Silex is derived from quartz, mock crystal or flint, and is the most abundant of earths, in rocks, clays, and soils.

Clay is next abundant to silex, and found in primitive and secondary, and in all soils. Clay-slate is 49 silica, 23 clay, 11 oxide of iron, and 5 potash.

Werner teaches that what we call *primitive* rocks, were originally a compost of quartz, mica, and felspar, in a solid crystalline state, without any remain of either vegetables or animals. The subdivision or disintegration of these, formed a second series above them, which he calls *transition* formations, and in them some shells are found. Above these are strata of *floetz* rocks, in which shells and simple forms of vegetables are found. Other successions then lie one above the other, till we arrive at the surface.

Mineral bodies are characterised by angles, straight lines, and plane surfaces; but vegetables and animals by rounded lines and convex surfaces, spreading from the central source of life.

The *external* structure of rocks, considered as mountain masses, is also distinct. This external structure, as forming mountain masses, may be *Stratified*, or stratiform, composed of strata. *Tabular*, or in large plates. *Columnar*, or polygonal. *Globular*, or in spherical masses. *Indeterminate*, including all unstratified rocks.

A *simple* rock is one unmixed homogeneous substance, whatever be its constituent elementary parts; as lime-stone, roof-slate, and serpentine. *Compound* ROCKS are composed of different mineral substances, either *cemented* by another mineral substance, as sand-stones and pudding-stones. Or *aggregated*, which implies an intimate union of the parts without cement: as in granite.

The *Elementary* substances which compose the varieties of stones or rocks are few, consisting only of the four earths, SILEX, CLAY, LIME, MAGNESIA, with OXIDE OF IRON, CARBON, and SULPHUR. These, in fact, are the solid substances of the mineral kingdom, and the first-mentioned compose above 19 parts in 20 of our planet.

The *fractured* surface of fragments broken from *simple rocks*, displays the internal structure of the parts called the *stony structure*. *Compact*, without any distinguishable parts or divisions;—or, *Earthy*, comprised of minute parts resembling dried earth. *Granular*, composed of grains. *Fibrous*.

composed of long and minute fibres. *Radiated*, when the fibres are broader and flattish, and so large as to be distinctly visible. *Lamellar*, or *foliated*, composed of thin smooth plates laid over each other. *Porous*, penetrated by pores. *Cellular*, or *vesicular*, when the pores have rounded cavities, like bladders, as in some lavas. *Slaty*, composed of thin leaves, or laminæ.

There are in minerals *eight* shades of white, *nine* of grey, *six* of black, *five* of blue, *twelve* of green and yellow, *fifteen* of red, and *eight* of brown, besides clear, dark, light, or pale in those shades.

Metals have five degrees of lustre—splendent, shining, glistening, glimmering, dull.

Minerals are compact solids, friable, or crumbly; or fluid, (as mercury, or rock tar.) Their qualities are—1. Hardness; 2. Tenacity; 3. Frangibility; 4. Flexibility; 5. Adhesion; 6. Unctuosity; 7. Coldness; and 8. Density.

1 expresses the hardness of talc; 2, gypsum; 3, calc. spar; 4, fluor spar; 5, apatite; 6, felspar; 7, quartz; 8, topaz; 9, corundum; 10, diamond.

All mineral productions, as to their substance, are comprehended in four classes: viz. the EARTHY, or the stones; the SALINE, or the salts; the INFLAMMABLE, as sulphurs, &c.; and the metals, or METALLIC ores.

The first class, or *earthy* minerals, include eight genera; as diamond, zircon, flint, clay, talc, calc, barytes, and strontian. Of flint there are thirty-four species, of clay thirty-two, and of calc, twenty.

The second class, or *saline* minerals, consist of only one genus, with 10 or 12 species, as natron, nitre, rock-salt, alum.

The third, or *inflammable* class, includes five genera, as sulphur, bitumens, graphite, charcoal, and resin.

The fourth, or *metallic* class, includes twenty-one genera, as platina, gold, mercury, silver, copper, iron, lead, tin, bismuth, zinc, antimony, cobalt, nichel, manganese, molybdena, arsenic, &c. &c. Of copper ores there are seventeen species, of iron fourteen, and lead ten.

The four varieties of Transition rocks are disentegrated primitive formations, re-united by a calcareous or argillaceous cement.

Sienite is a middle rock between granite and porphyry, composed of felspar and hornblende, or quartz and mica.

Porphyry is stone with a compact base, intermixed with crystals. The base is trap, and the crystals felspar or quartz.

Curved gneiss proves that it once was fluid. It is in slaty layers or plates, formed of felspar, quartz, and mica, separated by thin layers of mica, and it contains in its veins all the metals.

Serpentine is so called from its variegated colours, generally green. 32 silica, 37½ magnesia, half alumina, 10½ lime, with iron and carbonic acid 15.

Magnesia is obtained from magnesian lime-stone with the bittern of salt manufactories. The muriatic acid of the salt unites with the lime, and affords the magnesia. Exposed to the air it absorbs, in time, carbonic acid, and becomes lime.

Magnesian limestone effervesces little in acids, and it renders dilute nitric acid milky. It contains about 20 magnesia, 30 lime, 48 carbonic acid, clay and oxide of iron.

Hornblende is 42 silica, 30 oxide of iron, 12 clay, and 11 lime.

Augite is 54 silica, 22 lime, 12 magnesia, and 10 oxide of iron.

The *Schistose* strata are inclined from 52 to 70 degrees in mountains. Gneiss follows the sinuosities of the granite.

Mica-slate is mingled with quartz in masses; clay-slate has quartz in layers.

Sienite, porphyry, hornblende-slate, greenstone and basalt are composed of hornblende, augite, and felspar, in various proportions.

The PRIMARY and TRANSITION rocks contain few saline or inflammable fossils; but are the repositories of metallic ores, not often found in the third division, called *secondary stratified* rocks, in many of which numerous remains of ancient vegetables and animals occur.

Secondary rocks, consisting of greywacke and sand-stone, appear to be *depositions*, and lie more horizontally; and among mountains of primary formation they terminate at lower levels.

The *newer secondary* rocks lying *more* horizontally on the older, are at lower levels; so that the older rocks basset, or display their edges higher and higher on the sides of a granite mountain.

Rounded pebbles are broken fragments of rocks rendered smooth by mutual attritions, by water and tides.

Limestone, marble, and chalk, by burning, form *lime*, which does not unite with alkalies or oxygen, and only with sulphur and phosphorus among combustibles, and their and other acids. In becoming mild, it renders insoluble matter soluble, and hence its use as a manure under due caution. The smell in lime-slacking arises from the ascent of part of the lime with the vapour.

Lime appears to be a very active agent in all organization, for none appears till we arrive at lime strata in ascending; but, it seems to be undetermined, whether lime is the cause or the effect, that is, whether it is the remains of the first agent. Some suppose lime to be the debris of shells, while it is certain that there can be no shells without carbonate of lime, nor bones without phosphate of lime.

Magnesia is always combined with carbonic, sulphuric, or boracic acid, and is best prepared from the carbonate. It is found in serpentine and basalt.

Alumine is the basis of alum, and considered as pure argil or clay, which in general is combined with oxide of iron.

The rocks entirely mechanical, or formed by trituration, consist of sand-stones, limestones, gypsum, chalk, iron-stone, &c. and are called *secondary*.

Countries formed of secondary rocks are generally capable of cultivation over the

whole surface. These include, 1. Siliceous sand-stone, or grit-stone. 2. Argillaceous sand-stone. 3. Earthy lime-stone. 4. Calcareous sand-stone. 5. Chalk; which contain beds of gypsum, rock-salt, iron-stone, coal and trap, or basalt.

Pudding-stone is rounded pebbles embedded in cement, capable of being fashioned and polished.

Stalactites are crystalline spar, which oozes from the earth over the tops of caverns, like icicles, often reaching the bottom, and forming solid sparry columns; and proving how similar oozings cement all lower strata by the gradual precipitation of cement from above.

Staglamites are calcareous exudations and precipitations.

Calcareous spar is crystallized carbonate of lime, one of whose varieties is Iceland spar.

Iceland spar, the substance which produces double images, consists of 56 lime, and 44 carbonic acid, with a specific gravity 2·714. The faces are parallel, and inclined 105° 5′, but even and polished, splitting always on the face. From this cause it produces a double image, a direct one, and another, which is the result of all the reflections from all the surfaces, which, being regular, produce a definite effect.

Alabaster is gypsum, or calcareous, or common and oriental. Montamia best.

Emery is a mineral, containing 86 alumina, 3 silica, and 4 iron.

There are two substances called *marle*, one earthy and the other a stratum, but not hard. The earthy is used as manure, as well as the other found in beds, with lime-stone, and coal.

Barium, witherite, or carbonate of baryta, is a mineral found in Cumberland, Yorkshire, and other parts.

Borax is purified tincal, found in Thibet.

Pits of *Fuller's-earth* are found in Bedfordshire. There lie over the stratum several strata of red sand, six yards thick; then a stratum of sand-stone seven or eight yards; then other sands; then the Fuller's-earth. Below it is white free-stone.

Amber is a mineral substance, white or yellow. Its oil is used in *eau de luce*. When rubbed, it becomes negatively electrical, like sealing-wax. It is a vegetable gum; but some have considered it as honey converted into bitumen. Some pieces contain insects and leaves, of extinct species.

Tabasheer is a transparent fluid in the joints of the bamboo. It thickens till it is converted into a white solid, and is composed of silica. Humboldt discovered it in the bamboos of South America; and a solid pebble of it is so hard as to cut glass.

Tabriz marble is semi-transparent, and is the modern production of ponds which stagnate and concrete. The process may be seen in all stages, and the whole seems like freezing and frozen water. The bubbles of its springs also concrete in hemispheres.

The Lime of nature is made chiefly by zoophites and testaceous animals, by combining alkalies, or alkaline earths with oxygen. The lime in granite is 0·37, in green-stone 7·29. Lava and basalt have equal proportions. In fact, these and the atmosphere are magazines of alkalies.

We have been mystified about the origin of lime, by Davy's ambition to make metals from earths. A better knowledge of electrical action would have shewn him that his metals were only pure alkalies, which, for a moment, he deprived of their oxygen by an intense electric current. Fire effects nearly the same purpose, and water creates heat by the refixation, in burnt lime, of its oxygen.

The elastic bitumens of Derbyshire are ascribed to sublimation from the mineral veins and fissures in mountain lime-stone.

Derbyshire spar is barytes and Sicilian spar, strontian.

Angles of cleavage are those which result from cleavage in two directions, and always the same in the same substances.

Slaty cleavage does not necessarily accord with the direction of strata.—*Sedgwick.*

Carbonates of lime (calc-spar,) of magnesia, of protoxide of iron, and manganese are isomorphous, or alike in form, and other carbonates agree nearly.

The largest paving-stones are quarried near Barnsley. Portland and the hills near Bath yield stone for building. Newcastle and Rotherham, grindstones. Granite is supplied from Cornwall, Mountsorrel, and Aberdeen. Large slate quarries exist in Wales and Scotland, at Swithland and Ulverstone.

Portland stone is coarse grit, cemented with earthy spar.

Potter's clay is 43½ silica, 33 alumina, 3½ lime, 18 water, and 1 oxide of iron.

The alkalies exist as compounds of oxygen and a base of pure alkali, or nitrogen, which in potash is 83 per cent., and in soda 75 per cent. They are separable by the action of galvanic poles, which involves and carries the oxygen to the negative pole, and the alkali to the positive.

Zircon, glucine, yttria, barytes, strontium, thorina, and some others, are mineral curiosities, discovered only by the decomposition of peculiar substances.

When substances are divested of all their foreign materials, the remainder is called carbon, or pure matter.

The earthy minerals are called *Silex*, and the compounds in which it chiefly prevails, as opal, hornstone, chalcedony, garnets, slates, clays, hornblende, &c. This with *Alumine* and *Magnesia*, compose 230 different species of minerals.

Silex with potash forms about 60 species, as mica, feldspar, talc; and with soda, &c. lava, basalt, pumice, soap-stone, talc, &c.

Lime, with carbonic acid forms spars, stalactites, limestone, marble, oolite or beds of stone, chalk, marle, tufa, &c.; with clay and iron, lias under oolite; with magnesia, pearl-spar and magnesian lime-stone; with fluoric acid, fluor spars; with sulphuric acid, gypsum, &c.

Barytes with sulphuric acid forms heavy spars. Potash and nitric acid form nitre. Soda with carbonic acid, natron; with bora.

places. The rocks are 120 yards below the surface. The quantity made at Northwich, Winsford, &c. is full 400,000 tons, and employs 7 or 8000 hands. Price 10*d.* per cwt.

Rock-salt is chiefly exported, and our white domestic salt is the evaporation of brine springs. Mines of rock-salt, near Northwich, yield about 80 or 90,000 tons, and of white salt about 300,000 tons are made. The duty by the bushel, in 1815, was received on 15 million bushels, of which 2 were retained for home consumption. The export is immense, 4¼ million bushels to Europe, and 5¾ to North America.

Crystals and Precious Stones.

Nature and art present Crystals, both regular and irregular. To procure regular and well-formed crystals, by art, *time*, *space*, and *repose* are required.

To dispose a substance to crystallization, it is necessary to reduce it into the most complete state of division; which may be effected by solution, or by an operation purely mechanical.

The same chemical elements in the same proportions generally exhibit the same crystalline form.

The shape of the fundamental atoms, and the pressure of the air, produce crystals.

Solution may be effected by water, as with salts; or by fire, as with metals; the solution is complete only when a degree of heat is applied sufficiently intense to convert them into gas.

Some crystallized salts contain above half their weight of water, yet are dry.

When fluids evaporate and the residuum becomes solid, or when they freeze, they generally solidify in regular figures called crystals, either cubes, or four-sided, six-sided, eight-sided, or twelve-sided figures, or terminated by ends always regular. The separation and analysis of these figures reduce them to primitive forms.

1. In the parallelopiped, with six parallel sides, there are forty species.

2. In the octahedron, consisting of two four-sided pyramids, joined at the base, thirty species.

3. The tetrahedron, of four equal triangles, belongs to only two ores of copper.

4. The six-sided prism, consisting of six equal right-angled sides with a six-sided base, has seven species.

5. The dodecahedron, of which there are two figures, one the rhomboid and the other the triangle. Two have rhomboid sides, one garnet, and only two the other.

There are from 12 to 1500 different crystals; and 642 of carbonate of lime.

Hauy, in his theory of crystallization, conceives that all the forms may be produced by atomic molecules of three species. The tetahedron, the tringular prism, and the parallelopiped, of four, five, and six sides: and Wollaston conceives that these figures may be formed by piling spherical atoms as the fundamental form.

The crystals of congealing water shoot at an angle of 120°. When solutions freeze, it is the water that freezes; the foreign substance is entangled or separated.

When water solidifies into ice, its crystals cross at angles of 60°, and enlarge the bulk nearly an eighth, with such force as to explode rocks, trees, and even cannon.

The diamond is often in the octahedron form, but it varies.

Gold, silver, copper pyrites, and salt, crystallize as cubes.

Calcareous spar (angle 105°,) quartz, emerald, and tourmalin crystallize as parallelopipeds, with rhomboidal sides, and unequal angles.

Diamond, the magnet, antimony, and bismuth, have the regular octahedron, and topaz the same with right-angle bases.

Gold and silver crystallize in four-sided pyramids: copper the same: tin in rhomboidal prisms: lead in four-sided pyramids: zinc the same: bismuth in four-sided parallelopipeds: antimony in oblong perpendiculars: arsenic in tetrahedrons.

Fluor spar and common salt make cubes.

Nitre a six-sided prism, sulphate of magnesia a four-sided prism.

Sulphur and carbonate of soda the same, in two pyramids, rhomboid base.

Emerald and cinnabar six-sided prisms.

Common salt dissolved in viscid liquids crystallizes like leaves and branches of fir.

Calcareous spar crystallizes only in rhombohedrons, fluor spar in cubes, and quartz in six-sided pyramids.

The crystal, from *sulfure parallelique*, has 134 faces; calc spar has 47 various forms.

Chemical similarities lead to crystalline similarities, as in the salts of the phosphoric and arsenic acids. Soda, &c. is said to be isomorphous.

Goniometers are delicate instruments for measuring the angles of crystals, and a very accurate one is Brewster's.

The *diana arbor* is a crystallization of silver and mercury in nitrous acid.

Corundum is a stone, which, in crystals, is a six-sided prism, called adamantine spar. The amethyst, ruby, sapphire, and topaz, are varieties of this spar, differing chiefly in colour. The amethyst is reddish violet; the ruby red; the sapphire blue; and the topaz yellow:—termed oriental.

The Emerald is now found only in Peru. The oriental emerald is a green sapphire. The beryl is a variety of the emerald, of a paler green or blue. The emerald of Brazil is a tourmaline.—Mount Zabarah, near the Red Sea, is an emerald mine, with extensive excavations; and other emerald quarries exist in the same vicinity. The emerald is 64·5 silica, 16 alumina, 13 glucina, 3·26 oxide of crome, and 1·6 lime.

The tourmaline is hard enough to scratch glass, and becomes electric by heat. It is transparent when viewed across the thickness of its crystal, but opaque when turned in the opposite direction.

Apophyllite, or fish-eye-stone, has a pearly lustre, like moon-stone, and its crystals are various.

Leucocyolite is a name given to a variety of apophyllite.

Cairngorm is a species of quartz.

Agates are aggregates of different species, as quartz, flint, amethyst, &c. differing in colour and transparency. Mocho stones, containing little slips of moss, and variegated Scotch pebbles, are agates.

Glauberite is a crystallized salt, composed of nearly equal parts of sulphate of lime and sulphate of soda, without water.

Analcime, or cubizite, is found in grouped crystals, deposited by water in the fissures of hard lavas.

Zirzone is a hard transparent stone, susceptible of a fine polish, and has a double refraction. It has two varieties, hyacinth and jargon: the former yellowish-red, and the latter without colour.

The Oriental garnet is red, and the common garnet brown or green, of the size of a pea or larger.

The hardness of precious stones is in the following order; diamond, ruby, sapphire, topaz, hyacinth, emerald, garnet, amethyst, agate, torquoise, and opal.

In Bundelcund there are diamond mines, in a range of hills near Pannah. One of them produced the largest known diamond.

Diamonds are found in association with sand or alluvium, which contains grains of gold. The chief districts in India are on the Kistna, near Condapilly, and the Munnuddy, near Chunderpoor. In Borneo they are found at Landak. They seem to form a stratum. In Brazil the district is called Minas Geraes, 50 miles by 25, near Tejuco.

The Portugal diamond weighs 1680 carats, the Mogul 280, the Russian 195, the Austrian 139½, and the French 136¾. The first is unpolished; the second lost 600 carats in cutting, &c. The Russian was the eye of an Indian idol, stolen, and sold for £90,000 and 4000*l*. annuity. The Austrian was bought on a stall, as a piece of rock crystal. The French was sold to the Regent of France for about £120,000. Their sp. gr. 3·5.

The largest known diamond belongs to the rajah of Mathan, in Borneo, and it weighs 367 carats. He has been offered £12,000.

A diamond carat is 3·174 troy grains.

Cornish diamonds are transparent quartz in six-sided pyramids.

Diamonds are imitated by combining one-half red or white lead with silex, potash, and some borax or arsenic.

Near Linken, in a cave, rock crystals have been found weighing 4, 5, and 800 cwt.

The exudations which form crystals are a very extensive mode of rock formation in all varieties.

Metals.

Some mineralogists suppose that metals, &c. fill up fissures from *above*, others by heat from *below*, and others that they are contemporaneous with the rocks. The Editor advances a fourth theory, that they are generated by long-continued galvanic action between mixed rocks, and are the *Aura* of the rocks, combined with the oxygen, and nitrogen and hydrogen, whose actions and re-actions are electricity. The results are the matrix, a compound of some of the peculiar aura with oxygen and hydrogen.

The age of metals is judged by that of the rocks. Iron and manganese are found in the mica part of granite; tin and molybdena occasionally; silver and copper are found in both series; gold and antimony in the lower secondary; while lead, zinc, and mercury are found only in secondary formations.

In density the order of metals is platina, gold, silver, mercury, lead, copper, tin, iron, zinc, all of which, except the first and last, were known to the Egyptians and Greeks.

Few metals are found pure, or native; but in ores, gangues, or compounds, combined with oxygen or acids; often two or more resulting metals, with sulphur, arsenic, &c. in veins of rocks. The foreign bodies are called *mineralizers*,—sulphur as to lead, forming sulphureret of lead, called galena. The sulphur, as well as the lead, seeming to be a result of galvanic action between the surfaces of the rocks or earths.

Metallic veins are found chiefly in the oldest rocks, called primitive or transition, but they occur also in lower secondary rocks, and sometimes higher.

Earths constitute rocks, but metals, for the chief part, exist only in veins and fissures of rocks, and they must therefore be more recent than the rocks and earths.

Proximity is not essential to electrical influences, and the walls of fissures may be affected by excitements from a distance.

The average of veins or lodes is 3 or 4 feet in diameter, but they vary from 1 or 2 inches to 10 or 20 feet.

Fissures or rake-veins divide all the strata for unknown depths, sometimes perpendicularly, but oftener obliquely. They are slips of equal width, or chasms wider at top. Those from East to West contain ores, and those from North to South at the intersections.

The mineral contents of lodes are varied, says Fox, by rocks and strata, through which they pass, and miners speculate accordingly.

The mineral results in ores and crystallizations are, therefore, direct products of the oxygen and hydrogen, rendered active in electricity, and of the exudations and aura of the rocks and strata.—*Phillips.*

Metals are always found as alloys, sulphurets, oxides, or salts.

Gold, platinum, and columbium, are found only as alloys.

Silver, mercury, copper, iron, antimony, arsenic, and cobalt, in the four states.

Lead and zinc in the three last.

Others various, in two or three states.

Tungsten, uranium, titanium, chromium, and tantalium, only as oxides.

The mineral veins of Cornwall traverse both the granite and slate rocks without interruption. They are highly inclined tabular masses of great extent. On a small scale, they exhibit numerous curves and irregularities, both in direction and dip, with very variable breadths: but on a large view have an approximation to a right line. Their

composition is chiefly quartz, with other earthy minerals, but in many places mixed with metallic substances, viz. copper and iron pyrites, vitreous copper ore, oxide of tin, blende, galena, with admixtures of small quantities of other minerals; as native copper, red oxide, carbonates of copper, salts of lead, &c.: all frequently so intimately and indiscriminately mixed (mechanically) with the rock-contents of the vein, that their separation is among the most difficult and expensive of the mining operations. These irregularly-distributed masses, veins, granules, crystals, and other forms of the ores, have usually a prevailing dip longitudinally through the vein itself (*stuts* or *shoots*;) and this is almost universally FROM *the granite, and* TOWARDS *the slate*, whichever of them may be the containing rock.

Lodes of copper are generally covered with brown ochre, friable quartz (gossam,) &c. with tin on one side and the gossam between. The copper is a bi-sulphuret, or sulphuret, and the tin a peroxide. Sulphurets of iron (mundik) and zinc, and also of lead, abound in the lodes likewise.

The sides of lodes are quartz, shorl, and friable rock. Fluor spar appears with copper, and chlorite with tin, in veins which lead to metal lodes in other rocks, and in these of different metals. Rocks near lodes are less hard.—*Fox.*

Cross veins of quartz, and others of earthy matters, run N. and S. in all depths and lengths, and dislocate the metal lodes. They also contain galena, or sulphuret of lead, iron ochre, arsenical cobalt, and, when E. and W., sulphuret of silver.

At Huel Vyvyan the lode, in granite, is from 2 to 40 feet wide.

In Chili the copper and gold lodes run nearly E. and W., and the silver every way.

Metalliferous veins originate in cracks and crevices, which extend irregularly to unknown depths. They occur mostly in primary or transition formations, in parts in which stratified rocks adjoin crystalline rocks; for example, near the junction of the granite with overlying slates. Veins vary in width from an inch even to 20 or 30 feet; but in the Cornish tin and copper mines they are from 1 to 3 feet. In narrower veins the ore, as might be expected, is more metallic.

Ores are of four kinds:—

1. Mineralized with sulphur or sulphurets.
2. Mineralized with arsenic.
3. Mineralized with sulphur and arsenic.
4. Mineralized with saline substances.

They are not always found where formed, or have been transported in fragments.

When the Editor, in his theory of the growth of metals, alludes to *aura* of the substances in correllative action, the exhalations from the lower parts of the vein are also to be considered. These may greatly contribute to the formation of the ores on the sides of the vein, for the veins probably proceed through the granite, and may contain vapours *sui generis*.

The substance forming the outer coat of the vein is often intermixed, or forms layers alternating with the ore; called the *matrix*, gangue, or vein-stone.

Sometimes the ore extends in a compact mass from one side of the vein to the other. Metallic veins often divide and unite again, and sometimes separate into smaller branches, called strings.

Veins, in hard granite, seldom afford useful metal; but, in those of soft granite and gneiss are found tin, copper, and lead. Copper and iron are only found in those in serpentine. Lead, tin, copper, iron, and other metals are found in the veins of chlorite schist. Grauwacke, in large masses, with few fragments, is often metalliferous, holding the precious metals, iron, lead, and antimony; and sometimes veins or masses of anthracite.

Lime-stone is the most metalliferous of the secondary rocks, and lead and copper are the metals usually found in it.

When veins in rocks are exposed to the atmosphere, their superficial appearance often indicates the metals they contain. When a vein has fluor spar, it is associated with metallic substances. A brown powder at the surface of a vein indicates *iron*, and often *tin*; a pale yellow powder, *lead*; and a green colour the presence of *copper*.

When the dislocations or fractures of strata are filled with stones or earth, and the separations are wide, they are called *faults* or *dykes*; but when filled with metallic ores they are called Veins.

In these last are found the ores of metals, separated from the rocks by gypseous spar, quartz, clay, or earth, called the matrix or rider of the ore. When the veins are not filled up with matrix, the ores are crystallized round the cavity.

The sulphur, arsenic, and earthy substances are separated by washing, roasting, reducing, &c.

In the earliest ages no metals were used but those found pure, as gold, silver, and copper. The smelting of ores was a comparatively late invention, and ascribed to observations on volcanoes and the burning of forests.

The *genera* of minerals are divided into *species*, and again into *sub-species* and *varieties*, according as they agree, or differ, in external qualities, shape, colour, fracture, hardness, &c.

Metals are considered as undecomposable substances, yet all those that are inflammable must contain hydrogen.

They are twenty-three in number, with chemical ones.

Platina, and the recently-known metals, palladium, rhodium, osmium, and iridium, have only been discovered in the sands of rivers.

Gold and *Silver* are found in primary and transition rocks, porphyry and sienite, and the lowest sand-stone. Gold has been occasionally discovered in coals, and abundantly in sands of rivers.

Mercury is found in slate, lime-stone, and coal strata.

Copper in primary and transition rocks,

sienite, and occasionally sand-stone, coal-strata, and alluvial ground. In North America are found, on the surface, masses of native copper, of many thousand pounds weight.

Iron in every kind of rock.

Tin in granite, gneiss, mica-slate, and slate.

Lead and *Zinc* in primary and transition rocks, except trap and sepentine; in porphyry, sienite, the lowest sand-stone, and occasionally in coal-strata.

Lodes and mines are, by many, supposed to have been passes of streams of water choaked up; and in most mines such streams still remain. In Cornwall, they run from east to west; but, in other countries, they often run from north to south.

The tests of a probable mine are mineral waters, trees or grass discoloured, metallic ore or sand, and the products of boring.

Gold is yellow, copper red, iron grey, lead blue, and cobalt and manganese grey; all the rest are white.

The mines in the Cordilleras, in America, are remarkable for their richness. The most important are the silver mines; and there are several of gold, quicksilver, copper, and lead. In Chile are several silver and some important copper-mines. The richness of the silver-mines of Potosi may be judged of from the fact that above 1300 millions of dollars have been coined there since 1545; but the ores are now poor. On the opposite side of the chain, in a low plain, are the silver mines of Guantajaya, famous for the large lumps of solid silver, which they formerly furnished, and of which one weighed 800 lbs. In Peru, there are 40 districts particularly famous for their gold and silver mines. Gold is found especially in the provinces of Guailas and Pataz, and silver in the districts of Guantajaya, Pasco, and Chota. The mines of Pasco, 25 years ago, produced more than two millions of dollars yearly, and the mines of the province of Chota now furnish about 42,000 lbs. troy of silver every year. The quicksilver mine of Guancavelica, in Peru, is the only one in South America.

In Peru, gold is as abundant as silver, but, for want of capital, it is obtained chiefly from the sand of the streams, near Illimani, Tipuani, Zorata, and Isola. It is also found in grains in clay, but sometimes in the mountains, in lumps, as one of 60 lbs.

Such had been the accumulation of the precious metals and stones in India, where the mines are indigenous, that it is generally estimated that Nadir Shah, in 1740, carried away not less than 400 or 500 millions sterling. In Jahanqueir's auto-biography, he relates that a golden platform around his throne weighed 40 tons. His throne and diadem were worth 4 millions. When he married the daughter of his minister, he presented her with as many lacks as amounted to 7 millions, and with a necklace of 40 beads, which cost him £2000 per bead. The province of Berar, on one occasion, furnished above 4 millions of gold. He spent, besides, nearly two millions on the tomb of his father Akbar, one of the wonders of India.

The silver-mine of Potosi is sugar-loaf, 9 miles round, 16,000 feet above the sea, and 2700 above the plain. The upper part has 5000 adits for mines. Since 1545, it has yielded 400 millions sterling. The lower part is as rich as the upper, but flooded with springs, and, for want of steam-engines and capital, the late produce per annum has been reduced to the eighth of a million.

The silver-mines of Portugalate, in Chicas, have ore six or eight times richer; and there are others at Chorono, Chuquisaca, Porco Lipes, Carangas, and Oruro. For want of fuel and engines to smelt the ores, the metals are separated by amalgamation with quicksilver, at a loss of 20 per cent.

The Mexican ores yield four oz. of silver per cwt. Those of Saxony 10 oz. The Mexican mines are deeper, but the veins thicker and more extensive. The mines are a lottery, but Count Regla derived for many years a million per annum from them, and Count Valenciana a quarter of a million, and the Marquis del Apartado got £800,000 in six months, from a mine.

Mines, in Chili, are worked by a proprietor, and one who finds capital called the habilitador.

In 40 years, from 1790 to 1830, Mexico produced £6,436,453 in gold, and £139,818,032 in silver. Chili, £2,768,488 in gold, and £1,822,924 in silver. Buenos Ayres, £4,024,895 in gold, and £27,182,673 in silver. Russia, £3,703,743 in gold, and £1,502,981 in silver. Total, 187½ millions, or 4·7 millions per annum.

The produce of silver in South America, at the beginning of the present century, according to A. Von Humboldt, was 3,259,153 marcs, about 2,036,970 lbs. troy (7½ oz. to the marc,) of the nominal value of six millions sterling. Of this sum, Mexico yielded 2,196,140 marcs; Peru, 573,958 marcs; Buenos Ayres, 463,098 marcs, and Chile 25,957 marcs. Gold is obtained by washing.

The mines of Mexico, in 1809, yielded 28 millions of dollars, but they have since been on the decline.

The mines of the Altai mountains are very important; with a yearly produce of upwards of 1875 lbs. troy of gold, 37,500 lbs. troy of silver, and a considerable quantity of copper, iron, and lead.

South America, per Humboldt, yields per annum 43,500,000 dollars' worth of silver. One mine is the third of a mile deep, and 8 miles in length, employing 3000 miserables.

Georgia, the Carolinas, and Virginia have gold-mines, which, in 1830, produced 466,000 dollars' worth of half and quarter eagles, the whole gold coinage being in that year 643,105 dollars' worth. The silver 2½ millions, and copper 17,115 dollars.

In New Grenada there are several silver-mines; at Aroa, in Caraccas, a copper-mine exists, which yields from 1400 to 1600 cwt. of metal yearly, and, at Santa Fé, rock-salt and pit-coal are found.

The lead-mines of Adra, in Spain, are the

most productive in Europe. Our lead is chiefly Derbyshire.

The iron, silver, copper, and lead-mines of the Hartz, are Osterode, Claustal, Goslar, Oker, Hertsberg, and Kőnigshutte. They employ from 20 to 30,000 people, and, though badly paid by royal proprietors, the mines yield no surplus profit. They carry castings to great perfection.

The silver-mines of Huantaxaya, near Ignique, are 2800 feet above the sea.

The mines of Peru and Mexico yielded 3 millions of gold and silver, in 1834, and others in South America about 1 million. In the same year, the United States yielded $\frac{3}{4}$ of a million of gold.

Europe consumes 6 millions worth of gold and silver annually, for plate, jewellery, and ornaments. Gold coin wastes a half per cent. in 16 years wear, and silver from two to five per cent

The mines of Hungary, including those of Transylvania, and of the Bannat of Temeswar, compose four great districts. The whole produce amounts to 3,250 lbs. troy of gold, 53,125 lbs. troy of silver, 36,000 to 40,000 cwt. of copper, 6 to 8000 cwt. of lead, and about 60,000 cwt. of iron.

Besides these, there are, in other primitive mountains, important mines in the Ural, Vosges, and Black Forest, Hartz, Saxony, Villefort, Great Britain, Norway, Sweden, Pyrenees, Alps, Ardennes, Nertshinskoi, Spain, Asia, and Africa. Besides others in the Floetz mountains, and the washing of platinum tin, precious stones, &c. in alluvium.

The obtaining of *gold* in mining countries costs about fifteen times as much as silver; and this cost affects the future price in the market in that proportion.

The gold-mines of Borisovsk, in Siberia, by washing and the findings of gold at Tagilsk, in masses 2 to 3, and even 18 to 20 lbs. are most productive. The masses are found but a few inches below the turf, and yield annually 12,000 lbs. Other alluvium, at Vilkni, have yielded 5 or 6000 lbs. The same district yields abundance of platinum. In 1833, the gold produced was 161 poods, of 38 troy lbs., and the platina 39 poods.

Gold is too soft to be used pure, and, to harden it, it is alloyed with copper or silver. In its pure state, gold bullion is considered as 24 carats, and then it is sold by the number of carats of pure gold, and gold of 22 carats is that used in our coin; two parts of which is copper or silver. Gold plate is about 18 carats, or one-fourth copper.

The hundred-thousandth part of a grain of gold may be seen by the naked eye, and a cube of gold, whose side is but the hundredth of an inch, has 2433 million of visible parts. A cylinder of silver, covered with gold leaf, may be drawn out 350 miles long, and yet the gold will cover it.

A fibre of silk, a mile long, weighs but 12 grains, so that it requires 583 fibres, a mile long, to weigh a lb. avoirdupois. 56 square inches of *gilding* weigh but 1 grain, so that a troy lb. would gild 2240 square feet, or 46 feet each way. *Gilding on silver* is still thinner, or only the 14 millionth of an inch. Gold wire may be extended 50 miles to the oz. A grain of cerulin from indigo, or aloetic acid, will tinge 5 pints of water blue or crimson. (Yet, small as are the ultimate atoms, they must have an upper and under side; and the forms being definite, their own union produces the phenomena of *cohesion*, since no external instrument can penetrate them, and the vibrations of blows are too wide to affect them separately. Brittle bodies consist of compounded atoms, and such atoms divide by motion or blows.)

Gold-leaf can be reduced to the 300 thousandth part of an inch, and gilding to the ten-millionth. Silver-leaf to the 170 thousandth. The specific gravities are 193 to 105.—*Kelly's Cambist.*

Lace gilding is the millionth of an inch thick: gold-leaf the 200 thousandth. Platina wire may be the 50,000th of an inch. 500 inches of gold wire has been drawn from a grain. Tin-foil is the 1000th of an inch; that is, 200 gold leaves are only equal in thickness to one of tin-foil.

One grain of gold will cover 7¼ inches each way, or 52 square inches, or be 1500 times thinner than writing-paper, *i. e.* a sheet of writing-paper would be 1500 leaves.

A mass of 25 lbs. of pure gold has been found in Siberia.

Silver-leaf breaks at the 160,000th part of an inch, or three times the thickness of a gold-leaf. It tarnishes from sulphur, and dissolves in sulphuric and nitric acid.

Silver can be beat into plates, of which 110,000 make an inch, and drawn into wire, of the 13th of an inch sustaining 137 lbs.

The weight of an ingot of silver is from 50 to 60 lbs., and the weight of an ingot of gold is 15 lbs. troy.

The *quicksilver* mines of Carniola are the most productive in Europe, and have been explored 900 feet deep. The mercury is found in clay-stones, and it often issues from the rocks spontaneously. The mines yield 12,000 quintals, or 1200 tons weight per annum, and yield a million of florins to the imperial revenue. They yield also half as much native cinnabar.

A cubic inch of mercury, at 62° 30′, weighs 3425·35 grains.

The veins in the north of England produce ores of various metals, but chiefly sulphuret of lead, and in limestone.

Ireland yields copper in the southern counties; and the hill of Croghan Kinshela, in Wicklow, has yielded gold, but not sufficient to sustain works. One lump of 22 oz., and another of 18 oz. The entire produce, in 20 years, did not exceed a few hundreds per annum. Mayo abounds in basaltic dykes, to the number of 11, of great length, and intersecting the rocks from the gneiss to the limestone.

The *platinum* of commerce is found in the Spanish mines in South America in grains, and appears to be a compound of eight several metals: as palladium, rhodium, iridium, osmium, &c. A platinum wire, of the thirteenth of an inch, will suspend 274 lbs.

Cornwall is the most productive and celebrated of the mining-districts of Great Britain. The mines run from St. Austle westerly to St. Agnes, by Redruth to St. Ive's Bay, and on the surface it is a dreary district. The county also abounds in granite, with various proportions of felspar, quartz, and mica.

The mines are tin, copper, and lead; and in strata of schistus and granite. The tin is calciform and glass-like, the matrix argil or silex; and the world has been supplied with this metal from hence since the Phœnicians.

Tin is found as tin-stone, of a brown colour, composed of 77 of tin, 21 of oxygen, and 2 of iron and silex. It is obtained from granite or schist veins, sometimes 40 feet wide, and of indefinite depth, being worked above 1200 feet.

The tin-mines yield latterly about 4000 tons, formerly only 2750. Two tons of Banca tin are imported at 50*s.* per cwt. duty, and re-exported; but Banca tin supplies all the East. The exports of British tin have been two tons, and are now not half a ton. The price has fallen from £140 to £75 per ton.

Cornwall is now more celebrated for copper than formerly for tin. In 20 years the produce has risen from 7 to 12,000 tons. Other copper-mines in the United Kingdom yield about 2000 tons. Copper has fallen from £120 per ton to £105.

Copper, now so important a product, was not produced till the Revolution.

The Huelor mine is 840 feet deep, and spreads 1¼ mile, employing 1300 people.

The Poldice mine yields 1000 blocks; but as copper follows the tin, many of them now are copper-mines, from ore of pyrites and sulphur, all among granite, and inclined from 60° to 76°.

Crennis, Huel, Alfred, and St. George's are the most productive at present.

The bottom of the Consolidated Mines, in Cornwall, is 1740 feet below the surface, and 1440 feet below the sea-level. That is, the third and 2-7ths of a mile, or the 12,000ths of the earth's radius.

Near Helstone there are two lead-mines, and at Endillion one of antimony. Gold and silver are also found, as well as bismuth, asbestos, and lapis calaminaria.

The Tintagel slate-pit is 300 yards long, 100 broad, and 80 deep. Moor-stone, or granite, slates, and china-stone, or steatites, for fine pottery, are also sources of wealth, and the whole employ from 12 to 15,000 people of all ages.

The Cornish mines are 50 of copper, 27 of tin, 20 copper and tin, 4 lead and silver, 2 copper and silver, 2 copper and cobalt, 2 tin and cobalt, 2 antimony—in all 82. There are also as many quarries for slate, freestone, granite, soap-rock, and china-stone.

Copper and tin-mines, and lodes, are generally situated near the junction of granite and killas, or porphyry and killas, and lodes of both metals are found in each, in an E.N.E. direction, and inclined at different high angles.—*Fox.*

The largest produce of copper was in 1832-3-5, about 12,200 tons. In 1837 it was 11,8?3 tons.

Ores of 3 or 4 per cent. of copper, are now smelted by improved processes.

From 1831 to 1837, 142,785 tons of ore produced 11,637 tons of copper, or 8·125 per cent. Before 1790 a fifth of produce, yielded a third of copper, or 12 per cent.

The steam-engines perform all the work, raise the ore and rubbish, and also the workmen, who, in the Consolidated Mines, work at an average depth of 1380 feet.

The wages of l bour are miserably low; the tributers get but 14*s.* per week, the tutworkers but 12*s.* 6*d.*, the women 4*s.*, the boys and girls 3*s.*

The labour is about 5-8ths the value of the ore, and the materials form other 3-8ths, only one in five or six of the mines being profitable.

60,000 hands are employed in Cornish mines, but they relieve every 6 or 8 hours, according to depth of shaft.

Copper, in tin-mines, has been produced for a century and a half; but copper-mines, as such, were not worked till Newcomen's engine, about 1720. Watt's engines, in 1769, gave a new impulse.

The dynamic unit of the Cornish engines, is a lb. lifted one foot. The product of the lbs. into the feet raised, divided by the bushels of coals, is the duty of an engine. In 1837 there were 58 engines, and their average duty was 47 millions of lbs., while that of the best engine was 87½ millions of lbs. of water, raised one foot by a bushel.

The pressure of the steam, in the Cornish engines, is 50 or 60 inches above the atmosphere. The expansive action is extended to two-thirds or three-fourths the whole descent of the piston.

One bushel of coals now does the work of 16 formerly in the Cornish mines, whose gross power is equal to 44,000 horses.

In Anglesea, the Crennes mine yielded £84,000 in a single year, but has been worked out.

Swansea is the focus for smelting copper ore, and all the Cornish and Irish ores are conveyed there and to Meath. The deleterious effects are visible in the surrounding vegetation.

Tin is cast into blocks from 3 to 4 cwt.; and then assayed in Cornwall, at Lestwythiel, Truro, Helston, or Penzance.

Dolcooth mine stretches upwards of a mile from east to west, penetrated by innumerable shafts. Its depth is 1200 feet. Five large engines are employed in bringing up ore and rubbish, and three in freeing the mine from its water. The persons employed, men, women, and children, amount to 1600.

The great Swedish copper-mine at Fahlun yields from the ore but one and a half per cent. and has the appearance, says Thomson, of iron pyrites. It is a vast open cone. It has been worked for 5 or 600 years, and when most productive yielded eight million pounds.

Copper wire, the thirteenth of an i ch

will sustain 302 lbs. Copper pyrites is a native sulphuret of copper. British Silver coin contains one-thirteenth of copper.

The Ecton copper-mine, in Staffordshire, is now working at the depth of 472 yards, being the deepest mine in England. The deepest mine worked in Europe, or in any part of the world, is at Truttenburg, in Bohemia, and it is 1000 yards.

No imported copper is used at home; nearly 8000 tons of British are exported.

The Stannaries are the tin and copper mines of Cornwall.

Malacca rivals Cornwall in its tin-mines.

No less than 770 tons of banca tin were imported in 1831, from Singapore, &c. and was again re-exported. It appears to be largely used by the Dutch, Chinese, &c.

A tin wire, the thirteenth of an inch, sustains but 34·7 lbs.

The *lead* mines in Derbyshire, Cumberland, &c. yield about 15,000 tons per annum. A lead-wire, the thirteenth of an inch, sustains 28 lbs.

Galena is the native sulphuret of lead, and often contains antimony, silver, and zinc. The ores of lead are sulphuric, and this is expelled by the heat of a reverberatory furnace. Putty is oxide of lead, or whitening and sweet oil. *Zinc* wire sustains 110 lbs., and if heated above 212°, it may be rolled very thin, and drawn into wire. At a red-heat it inflames, and disperses in flakes. It amalgamates with most of the metals, making a sort of paste.

Manganese has so great an aptitude to combine with oxygen, that, on being exposed to the air, it absorbs so much as to fall into powder. If thrown into water it decomposes, the water becomes green, and is found to have absorbed 0·15 of oxygen. If this be exposed to the air it turns brown, and is found to contain one-fourth oxygen. In a native state, the oxide contains four-tenths. From this cause the native black oxide is used to obtain oxygen gas, which may be expelled by heat. The red oxide of iron contains 0·41 of oxygen and arsenic acid one half.

Selenium is a new metal obtained by Berzelius from the pyrites of Fahlun. Its specific gravity is 4·32, and brown.

Cadmium is another metal in union with zinc, with a specific gravity of 8·604, and of a grey colour.

Wodanium is grey and the specific gravity 11·47.

Gun metal is 12 lbs. tin and 100 copper.

Zinc and copper form alloys in all proportions. 1 lb. copper to 2 zinc, is common brass. 1 of each is prince's metal. 4 of copper to 1 of zinc is the malleable brass in watch-work. 6 and 1 is harder than copper.

Tin and copper form valuable alloys in various proportions. 11 lbs. of tin to 4 of copper form speculums. 11 to 36 is bell-metal. 11 to 96 is the common casting for cannon. And 11 to 108 form cannon and statues.

Bath metal is 2 lbs. of brass, and nine ounces of zinc.

Iron, as well as glass, was accidentally discovered by a fire made of iron-stone in one instance; and of lumps of natron and silicious matter in the case of glass. Moses relates that iron was wrought by Tubal-Cain, Noah's brother, who was drowned in the flood; but Sanchoniatho ascribes it to Vulcan, or Hephistus, the first god-king of Phœnicia, Egypt, &c. Tubal-Cain and Vulcan are similar names, but Sanchoniatho speaks of no flood. The Greeks had very confused ideas about Vulcan, who, according to Manetho, lived about 6100 B. C.

Iron-stone is known to practical men by its weight and other characteristics. But no iron is visible in the fracture. It is as easy to believe that it is then formed from primitive atoms, as that it is an oxyde.

The air oxydates iron into the red or yellow powder called rust.

Iron burns brilliantly in oxygen gas.

The black oxyde of iron contains 79 iron and 21 oxogen.

The red oxyde, or peroxyde, is obtained by putting red-hot iron filings in an open vessel, and agitating them till they produce the common red paint.—It is this oxyde which produces the red colour of bricks and clays. It is 69 iron and 31 oxygen.

Carburet of iron, or iron and carbon, is black lead, or 19 parts of carbon and 1 of iron.

Phosphuret of iron is called syderum.

The *ores of iron*, or iron-stone, are considered as mixture of clay with oxyde of iron, from 15 to 35 per cent. of metal. To procure pig-iron from these stones, they are mixed with charcoal and lime in a large furnace, and the oxygen combines with the charcoal, and the clay with the lime, by which the grains of iron are separated and melted, so as to run out in a fluid state from the furnace. It is white, grey, or black, and when cool has a density of 7·5.

Cast-iron is a supercarburet of iron: and *wrought*, or soft iron, is the simple metal divested of foreign materials.

This cast-iron is then converted into bar or wrought-iron by being melted in charcoal and ashes with scoria of iron, and, by repeated forging, it becomes malleable.

Pig-iron is cast-iron, as it flows from the furnace. Its quality, for various purposes, is known by its fracture, but dealers judge by its surface. In general, one pig on the ground breaks another, which is let fall across it from an elevation of 7 or 8 feet. The softest breaks with difficulty.

White cast-iron is hard and brittle; and it does not seem to be well-understood to what this is to be attributed; while *black* is soft and tender, and bears all the marks of containing too great a quantity of carbon. The *grey*, or gun-metal, as it is sometimes called, is superior almost for every purpose; it is sufficiently soft to yield to the file, and it is much stronger than either of the other kinds.

Bar-iron is converted into *steel* by being *stewed*, while red-hot, with charcoal from three to seven days. It is then cast in

ingots, and its specific gravity becomes 7 8, and is subcarburet of iron.

These several conversions employ thousands of men in the largest and most imposing manufactories.

Steel has become a large product at Sheffield. It employs 60 furnaces, which produce 10,000 tons per annum besides some hundred moulting-furnaces, all which consume 100,000 tons of local coal. The other manufactories consume 200,000 tons, besides 38,000 for 75 steam-engines of an average of 18-horse power. Swedish iron is employed for cutlery, &c. in the proportion of 10 to 2 British.

In 20 years, the exports of unwrought steel have risen from 500 tons to nearly 2000, above half of which goes to the United States.

In forming iron-castings, to bear a transverse strain, it is common to increase their depth to several times their breadth; for the strength is as the square of the depth multiplied into the breadth. But, by the experiments of Rennie, this rule was not found to hold in a bar of the depth of four inches, and the breadth of ¼ of an inch. Cubes of 1-8th of an inch, taken from the middle of a large block, were crushed with a weight of 1440 lbs. Cubes of 1-4th an inch were not crushed with less than 10,351 lbs.

Iron furnaces, among the Romans, were unprovided with bellows, but were placed on eminences with the grate in the direction of prevailing winds. Blasting-bellows are now the most colossal structures in the entire range of manufactories, some of them being of such sizes as to be wrought by a steam-engine of eighty-horse power, and their roar on entering the fire may often be heard for miles. In the largest class of blasting bellows, the blowing cylinder is eight feet in diameter, and it discharges twenty-four cylinders per minute, or nearly 12,000 cubic feet of air with the force of 3 lbs. to the square inch; but, in general, one engine operates on different furnaces with 3 or 4000 cubic feet of air per minute. A single furnace thus smelts from forty to fifty tons of pig-iron daily. The old method was by water-machines, called Trompes.

Alloys of iron with silver are a 500th silver.

Iron is fibrous. Gold is crystalline.

The black stain, when acid is put on iron, arises from carbon.

The ore called *hematites* produces the purest iron, by ignition with charcoal.

Of the quantity of iron, South Wales produces 279½ thousand tons, Staffordshire 219½, Shropshire 81½, Scotland 37½, Yorkshire 33, Derbyshire 22½, and North Wales 25. The quantity has increased 100,000 tons per ann.

Colnbrook Dale is a winding glen between two hills, about eight miles long and two broad. It supplies iron ore, coal, and lime, to some of the largest melting and casting establishments in the kingdom. Iron-stone china is also made here, and the district has been a seat of astonishing production.

We export 71,000 tons of bar, 22,000 of pig-iron, and 14,000 in castings, besides 10,000 as rod and wire. Of anchors, &c. 2000 tons, hoops 12,000, nails 5000, and sundries 21,000. In all 157,000 tons. There is also exported 1710 tons of bars of steel, from Swedish wood-made iron. America, in spite of its Pittsburgh, is our greatest customer.

In 1740, the 59 charcoal furnaces of England and Wales produced but 17,380 tons of iron. About 1770, coke was preferred to charcoal, and in 1837, the produce is a million of tons.

In 1836, a million of tons of iron were smelted at a mean price of 7*l.* 10*s.* per ton.

Waste and increased density reduces every 100 tons of pig-iron to 70 of wrought-iron.

As 5 cubic feet of iron make a ton nearly, so our whole annual manufacture is 3½ millions of cubic feet, which in each dimension is 152 feet, or 50⅔ yards only. Then, as there are about 147 thousand millions of cubic feet in a cubic mile, so at the same rate it would require 42,000 years to make a solid mile of iron! But as the mine, coals, and lime, make 10 tons for every ton of iron, and their specific gravity is but 1.3d of the iron, so a cubic mile of iron would exhaust 30 cubic miles of materials, and our annual waste dug from the earth is 105 millions of cubic feet, and make a cubic exhaustion, or pit, of a mile in 1400 years.

There are about 400 blast-furnaces in France, chiefly worked with wood.

The steel and iron factories at *Pittsburgh* consume 11,000 tons per annum: 3500 in castings, and 7500 in rolling. 18 tons of nails are made daily, and there are seven steam-engine factories.

Daunemora is the largest iron mine in Sweden, and Fahlun is the greatest copper mine in that kingdom of rich mines. The ore forms a large vein in a hill, thirty miles from Upsal. It is wrought to a considerable depth by blasting, and the ore affords 50 per cent. of cast-iron. This is the iron which is converted into steel at Sheffield, and known by its mark of three balls. Its superiority is ascribed to its being smelted with wood instead of coke.

A gallery 6000 feet long, at 600 feet deep, has been recently formed in the silver-mine mountain, at Konigsburg, so as to carry out the ore horizontally.

Rushwa, Ije, and Watka, are the seats of the iron and steel manufactories of Russia. Sobakin was their Watt.

Magnetic pyrites is a sulphuret of iron, 63 iron and 37 sulphur, and called loadstone. Super-sulphuret of iron is iron pyrites, 47 iron and 53 sulphur.

Loadstone abounds near Magnesia, in Natolia, and hence the name of magnet.

Black lead, or plumbago, contains 9 parts carbon, and 1 of iron.

Mercury is found native, or combined with sulphur, called cinnabar. Calomel is 389 mercury, and 67 chlorine. Corrosive sublimate is 380 mercury, and 134 chlorine.

GOLD forms 3 oxides, 2 chlorides, and 1 sulphuret.

Silver forms 1 oxide, 1 chloride, 1 iodide, 1 cyanuret, and 1 sulphuret.

Iron forms 3 oxides—blue, red, and black, 2 chlorides, 4 iodide, 2 sulphurets, 1 phosphuret, 2 carburets, as cast-iron and steel.

Copper 2 oxides, 2 chlorides, 2 sulphurets.

Lead has 3 oxides, 1 chloride, 1 iodide, and 1 sulphuret.

Mercury has 2 oxides, 2 chlorides, 2 iodides, 1 cyanuret, and 2 sulphurets.

Tin has 2 oxides, 2 chlorides, and 1 sulphuret.

All in various definite proportions, and so with the less important and the chemical and factitious metals.

Fusibility and oxidation of metals is increased by being alloyed.

Looking-glasses are silvered with an amalgam of mercury and tin; and glass globes with an amalgam of lead, tin, bismuth, and mercury.

Brass is gilt with an amalgam of 1 gold and 8 mercury.

An alloy of 10 copper and 1 arsenic resembles silver.

An alloy of 1 platinum and 10 arsenic is fusible at a red-heat.

Tin and lead is the solder of the glaziers. It fuses at 360°.

Tin and lead; or tin, copper, antimony, and bismuth are pewter.

Three parts tin, 5 lead, and 8 bismuth, fuse below 212°.

Iron-wire, the 140th of an inch diameter, bears 5 cwt., copper 3, silver and gold 1¼, zinc 1, and tin and lead but ½. Hence iron is 20 times the strength of lead and tin.

Bronze is 1 tin and 10 copper.

Bell-metal 4 zinc, 1 tin.

Brass is 4 copper, 1 zinc.

Dutch gold 5 copper, 3 zinc.

Wootz is steel and silicum.

500 steel, 1 silver, harder than wootz.

100 steel, 1 platinum, is like wootz.

Sodium is procured like potassium, by the electrical or chemical decomposition of the mineral alkali, or the alkali from the ashes of marine plants, instead of pearl-ash. *Soda*, the oxide of sodium, is the chief ingredient in glass and hard soaps. Glass is soda united to earths and oxides. Soaps are soda united to oils.

In mining districts ancient laws and severe customs govern every thing, and perhaps some of the laws of Minos, fabled to be made for hell, still prevail in Cornwall and Derbyshire.

954 persons are ascertained to have perished by explosions in English and Welsh coal-mines, between 1810 and 1835; and 1600 in Durham and Northumberland only, between 1710 and 1810. Since Davy's lamp, 538 have perished in 18 years in those counties, and in 18 years before only 447; but a Committee of Parliament decided that Davy's principle was previously known to Clanny and Stephenson.

The examination of an ore is called the Docimastic Art. The pieces are cleared from foreign and stony substances. The pure mineral is pounded, and then torrefied or roasted in a shallow vessel, and the sulphur and arsenic dissipated. A certain weight of the roasted ore is then placed with fluxes in a crucible. The black flux for lead; copper and antimony are two parts of tartar and one of nitre, melted together. The flux of scopoli, for iron, is two parts of calcined borax, one of nitre, one of the ore itself, and a fifth of slaked lime. The vitreous flux for the same is eight of pounded glass, one of borax, and half of powdered charcoal.

When the mine yields native metal, or its oxide, no further process beyond that of picking and fusing is necessary; but, when it is combined with sulphur and arsenic, the ore must be cleared of the stony matter, or matrix. This is effected by a stamping-mill, consisting of pestels of wood, shod with iron and armed with cocks, and which are raised by the turning axis of a wheel. Water passes during this pulverization, and carries off the light and waste parts, and what remains is called *sclich*. This is afterwards worked with brooms and water, and the sclich, in being roasted, is deprived of its mineralizer. It is then melted in strong furnaces, excited by blasting bellows, or sometimes by a well-known machine called a trompe, made of a hollow tree, and a cask into which water falls, carrying a current of air to the furnace.

GEOLOGY.

Geology, or the History of the Earth, as it is and has been, deduced from its own natural records, is a new subject, raised into a noble science in our own age.

Till the commencement of the present century, mankind were so blind to subjects constantly before their eyes, that Dr. Plot ascribed all fossils to an imitative sympathy of the inert for the organic; and Voltaire gravely referred the sea-shells, near Geneva, to the wallets of pilgrims in the Holy Wars.

The first person who drew general attention to the subject was William Smith, a land-surveyor of Bath, who, in constructing roads and canals, observed that the *same strata* gave the *same fossils*, and that strata and fossils were always identical. This was a key; and no study ever became more popular, and raised itself into universal estimation more suddenly. Parkinson, Cuvier, Farey, Mantell, Brogniart, the German and Swedish miners, the Americans, the English in all colonies, and Sedgwick, Buckland, Murchison, Greenough, Lyall, Phillips, and Societies all over Europe, have been active in exploring beyond example.

The Editor has contributed his mite by shewing, that the increased projectile force needed in the perihelion, is the active swing of the mobile waters increased in the hemisphere, over which the perihelion is vertical in declination. The seas therefore accompany the perihelion south now, and north in 10,000 years; so that every 20,000 years the northern hemisphere has been, and will

be, as the southern hemisphere is now, and the southern will have an excess of fixed land, just as the northern has at present. This principle is presented as the master-key to the whole of these phænomena; and if the elevation appears to have been greater at one time than at present, it is easy to perceive that, as the inclination is a decreasing quantity, it was once wider, perhaps even 45 degrees; and then the perihelion action would be far greater, and the earth be tropical even to the centre of France, conferring constant sunshine for a month on the centre of Britain, and three months on the north of Scotland. Hence the tropical character of fossils in high latitudes.

Leonardo da Vinci was the recorder of correct opinions relative to fossil remains. Italy took the lead in these enquiries, but England was mystified by prejudices on this as well as other subjects, till within a century. Llwyd, Woodward, Nichoell, Brander, and Strachey, were our first collectors of what they ignorantly believed to be reliques of the Jewish Deluge.

Steno, in 1669, distinguished between primitive rocks and those which contain fossils; Arduino, Lehman, and Rouelle, about 1760, enlarged on these ideas of Steno, and classed rocks as primary, secondary, and tertiary, as products of different periods.

Werner, about 1780, classed rocks into primitive (as granite, mica-slate, and clay-slate;) transition, highly inclined like the primitive; secondary, (floetz or flat strata,) more horizontal. Trap-rocks, which resemble lava, were referred to volcanoes, but in general Werner referred to water.

Hutton, a Scotchman, referred the whole to fire and to volcanic agency, and seized on the local exhibition of basalt, as proofs of universal action. Even the metallic contents of veins, ascribed to overflowing liquid metals, were pressed into his theory.

Lamarck, Deluc, Cuvier, Brogniart, Parkinson, Webster, Mantell, Lyell, &c. &c. gave finish to the study.

The Greek schools, above 2000 years ago, treated of the world as of indefinite antiquity, and they speak of traditions, 10 or 14,000 years before their time, as facts not questionable from their antiquity.

The granitic groupe covers the unknown nucleus as mica, quartz and feldspar in granite, mica, quartz, and garnet in mica slate, and feldspar and hornblende in sienite.

There are, says Buckland, 8 varieties of crystalline unstratified rocks, and 28 well-defined divisions of stratified formations. Then, taking the average thickness at 1000 feet, they exceed 5 miles, but, as the primary and transition series much exceed 1000 feet, the whole may be 10 miles in thickness.

They are divided into primary, transition, secondary, tertiary, diluvium and alluvium; the four last being produced from detritus of the two first.

The *inclinations* of beds and formations arise, in all cases, from precipitation from floods while in progressive velocity, so that the law of settlement is the angle or side of the two forces, *i. e.* that of weight and that of horizontal velocity. Another effect of the two forces is the overlaying of strata, the nearer parts being carried farther than the denser, and lying therefore uppermost. Angles of inclination are, therefore, necessary effects of aqueous causes and deposits, and *declination* indicates the course of currents, ascents being created by perpendicular action, and descents by lateral currents. Horizontal beds were formed by still waters, the denser bodies forming the lower strata.

The declinations of the strata are, of course, dependent on the line of direction of the waters in tides and currents. Then the inclinations are simple and necessary effects of solution, precipitation, and deposit, combined with velocity. In stationary water, as in lakes or isolated basins, deposits would be horizontal. In water of great velocity precipitations would be arrested only by obstructions, and then form ridges of hills and mountains. With equal forces of velocity and precipitation the deposits would be at an inclination of 45°, and generally, as velocity exceeded precipitation, angles would be greater, and as precipitation exceeded velocity, angles would be less. This is as certain as Geometry.

The spiral direction of strata over strata with out-crops, such as we find at the surface, is exactly such a disposition as would arise from the velocity of water in carrying stratum over stratum, whether in solution, or by mechanical propulsion. In certain cases it would carry onward previously-laid strata, and hence that intermixture which baffles observers who are without a key.

The formation of sand-banks in rivers, and of hills and mountains, would result from any small obstruction to a current of muddy waters, flowing on the oblique side, for nearly all mountains have oblique and abrupt sides.

Troughs, or concave hollows, are the forms which the indurated strata appear to take in concreting, and then these are filled with the detritus of submersions and tides.

Wherever secondary rocks are formed, we may be sure that the tides have flowed over the place; and the strata of rounded pebbles that divide such sand-stone, and other rocks, are evidence of the sea level in the last southern absence of the perihelion.

These alternate rises and falls of the sea level, a few hundred feet higher or lower in both hemispheres, are the foundations of the various traditions of nations about some ill-understood flood.

In all countries, on digging to certain depths, and in mining, the remains of fishes, vegetables, quadrupeds, and birds, are found in the soil or embedded in the rocks, except in those of simple substance and primitive antiquity. The general regularity with which those that are marine are laid at one level, and those which are products of land are laid at another, lead to the conclusion that the sea has repeatedly covered the land for long periods of time, and that the land

has, at intermediate periods, been dry. The remains consist always, at certain depths, of species of animals, vegetables, &c. not now in existence, and often of genera not congenial to the present climate.

Cliffs or rocks in general are mere endurated sand, pressed and dried into stone; and as the sand varies in quality, the cliffs and sub-rocks vary while other changes are wrought by infiltration, pressure, and dessication. Then, as all land has been formed by tidal and sub-marine action; this economy governs all the phænomena of rocks, &c. many periods of 20,930 years must have passed to produce the varieties; but regular submersions and dessications, at such intervals, explain every thing.

In ancient formations are veins of gold, silver, tin, copper, lead, and zinc. In others, beds of coal and ironstone, or salt and gypsum, or freestone or limestone, or clay and iron. With a base of granite compounded of silex, carbon, alkali, oxygen, iron and manganeze, with water, air, and solar light.

The lowest rocks, it is therefore inferred, were at one time the surface of the earth and the seat of organic life. These appear to have been destroyed by some great revolutions, which brought new tribes of organized beings, while their kinds prove that the surface was covered with water. The subsequent appearance of amphibia, &c. prove the developement of dry land where these appear to have been swept away. Among later solid rocks, the monstrous race of herbiferous quadrupeds and gigantic lacerta came into existence, when the earth seems to have acquired herbage for their subsistence. The gypsum, &c. which now contains their remains, is covered with newer deposits, abounding in sea-shells, and above this stratum is found a new race of herbiferous animals of the genera of the elephant, rhinoceros, &c. Above them is the first loose soil, intermixed with marine substances, proving other immersions of the sea: and above this lies the soil which *the present race* of animals enjoy.

The principal constituents of all strata, are flint, clay, and lime, and their mixture.

Granite, gneiss, mica, slate, and quartoze rocks, beneath the limestone, have no organic remains.

In formation of soils, *first*, there is the green incrustation, called byssus by Linnæus, but recently proved by Drummond to be the primary germination of several species of mosses; *second*, when this decays, a very thin stratum of vegetable earth is formed, which affords a scanty support for the roots of the next year's crop of mosses; and, *third*, in process of time soil is formed of a sufficient depth for wall plants, whose accumulations of soil are more abundant.

The first organic remains appear in the early slate formations of the transition series, but they differ in genera and species from those found in carboniferous series.

In the transition period, the vegetables are cryptogamous, and animals do not appear till the transition limestone, lime being essential to their shells and bones, and the mountain limestone added to the variety of animals and vegetables in the immediately subsequent coal formations. In the second period, the dicotyledonous plants are equal to the cryptogamic. In the tertiary, the former predominate, and are now two-thirds. Monocotyledons are scarce in each geological period. The fossil flora is above 500 species—300 from the transition and coal, 100 secondary and 100 tertiary, all named.

The most popular view of the subject is this, that all the strata, to a certain depth, are loosely compacted and easily uprooted, disturbed, &c. by any submersion of masses of water or the sea; and that wherever a man resides, all beneath him has been many times, at great human intervals, dry land and sea, the successive surfaces having sustained plants and animals differing from each other, and from those who now occupy the surface. In proof, it may be added:—

That *primitive rocks* are crystalline, with no organic remains, embedded below all others, and also rising through all others.

That *transition rocks* are partly crystalline, and partly deposits with sea-shells, and lie above primitive.

That *alluvial* or *secondary rocks* are altogether deposits of ruins of others, and contain fossil shells, vegetables, and bones of animals: they lie above the two last.

And that *tertiary* are the upper and more recent formations of sand and clay, the alluvial or vegetable mould, and modern vegetables and animals.

In the preceding article is given a list of the primitive rocks, which in the first ages of our planet were its surface, indurated in knobs and projections, with corresponding valleys and hollows. By air and water, abradings, decompositions, filtrations, and re-compositions took place. Circles of developements and returns were generated. These were enlarged and extended to organic life. Other enlargements of these circles kept pace with incessant novelties in the materials. Till at length all the formations, from the granite to the vegetable mould, were generated, and with them all the varieties of organization which we now discover.

In the *oldest limestones* are found worms, tubipores, millipores, belemnites, ammonites, nautilites.

In *argillaceous schists* of primary formation are found the same, and corallites, echinites, fishes, leaves, reeds, palms, &c.

In the *lowest secondary sandstone* are found the preceding, with orthoceratites and pectinites.

In the *secondary limestone* below coal are found the same with the griphites, ostracites, buccinites, &c.

The *Coal* above the preceding evidently consists of fermented timber, with leaves and shells and branches of shrubs lying upon the beds, and shells, &c. in the shale between the beds.

Red marl, or sandstone, contains all the preceding, together with crabs, and amphibia, and fishes.

The strata between the preceding and chalk contain every variety of shells and zoophytes

Chalk abounds in fossil remains, like the preceding, with sponges, primites, tortoises, and parts of fishes. Above the chalk the lowest marine limestone, and two other strata above it, contain similar remains, with leaves of fuci, and the sandstone above is similar.

Chalk also contains marine substances, from the sponge to the alligator: and clay contains crabs and lobsters, shells, fishes, crocodiles, fruit, fossil wood, and seed-vessels of woods in great varieties.

The secondary sandstone contains both trees and shells. Lias and oolite abound in bivalve-shells, spines of fishes and bones of turtles, crocodiles, opossums, and fossil woods, besides ferns and reeds.

Gypsum, the lowest fresh-water formation, contains various large animals of the genus palæothera, canis, anoplothera, saurus, &c. besides birds, fishes, and palms.

Above the *gypsum* is a marine formation of gypsum and marl, containing marine shells, crabs, and fishes.

The *upper sandstone* contains various marine shells of a dozen genera.

Above this is another *fresh-water formation*, containing various animals with silicified wood, and remains of crocodiles, turtles, lobsters, sharks' teeth, and branches of trees.

Lyall distinguishes the tertiary epoch into five periods. 1. The *recent*, or the age of man; 2. The newer Pliocene; 3. The older Pliocene; 4. The Miocene; 5. The Eocene.

So different are the shells in the newer *Pliocene* tertia, that Lyall says, it is as difficult to find extinct species in them, as to find living species in the Eocene. He concludes, that only 1 in 30 Eocene shells are recent; 1 in 5, of Miocene; 1 in 2 in the older Pliocene; and 9 in 10 in the newer Pliocene, though very ancient, and in great elevations.

The *Eocene* mammalia are all of extinct species, and of these 40 were pachedermata, of which only four species survive, and those distinct.

The tertiary formations descend to the chalk-rocks. The next lower formations are the upper secondary, and below these the lower secondary or coal formations.

The *Eocene* period had the palæotherum, anoplotherium, large wolves, opossums, squirrels, owls, quails, pelicans, tortoises, crocodiles, and many fishes, but of species, and often of genera, all found in fossil states, different from the living specimens. The pachedermata, or naked-skinned animals, were then numerous. The vegetation was trees, as palms, &c. of warmer climates than Europe now, proving that the tropics were then wider. 16 degrees implies 91,500 years.

The *Miocene*, or second period of the tertiary, contained the dinotherium, 15 and 18 feet long, large tapers, cats and dogs, and the mastadon.

The *Pliocene* underlies the modern alluvium; but is as old as the races of men and living species, or many thousand years. The age proves, however, the inconceivable ages in which all the formations, from slate-clay to chalk, and from chalk to the vegetable mould, must have employed. Buckland says, millions of years, and the only question is, how many millions?

The *Pliocene* periods abound in elephants, and other pachedermata, also in oxen and large deer, hyenas, bears, &c. The seas contained whales, dolphins, seals, walrusses, and manati, but of species differing from the present. Lately, at Liege, human bones were found in a hyena's cave of this period, that is, prior to the last submersion, about 16 or 18,000 years since. M. Schmesling, the dicoverer, and Dr. Buckland differ.

The lower, or Eocene period of the Tertiary, had but 3½ per cent. of species, of recent shells; the second, or Miocene, but 18; the older Pliocene had from 35 to 50; and the upper, or last, has 95 per cent. of our shells. The gigantic lizards now disappeared, but there were land-monsters of vast dimensions. In this Pliocene full half are the same that are found in the alluvial, or still in existence. Among the relics are many of astonishing dimensions, as mammoths, mastadons, sloths, elephants, and the like; some of nondescript genera, and mostly differing in species from living races.

Five geological periods are imagined. 1. That of gneiss and mica-slate. 2. That of clay-slate and the coal-formations. 3. That from the lias to chalk. 4. That from the chalk to the alluvium. 5. That from the alluvium to the surface.

Buckland makes the primary series to include the coal formations; the secondary to include the chalk, and, above the chalk. In the tertiary series, there are 4 alternations of fresh and salt water remains, evidence of 4 entire revolutions of the perihelion. He has then suspended a separate volcanic formation.

Below chalk the remains are chiefly *marine*; but chalk and the coal formation, and upwards, contain *marine and land* remains.

The tertiary strata abound in animal and vegetable remains more like those which now live, but differing in species, and often in genera. We are also enabled to determine the parts of Europe which escaped submersion in the last perihelion visitation.

Werner made granite the base, or fundamental rock, but some moderns deny this, and produce instances that it often overlies others, and even allege, that it is often of recent formation. It is found in mineral veins, and hence supposed to have been forced up in a fused state. Felspar-porphyry rises through granite at Ben Nevis.

Granite, porphyry, and trap-rocks are not in strata, and they contain no fossil remains, either because they have been fused or are older than organizations.

The oldest *stratified* rocks are gneiss and mica-slate. The former consists of layers of felspar, mostly quartz, and mica. But in mica-slate the mica prevails. The two

forming alternations ascending from felspar to mica. They contain no organic remains.

Clay-slate or roofing-slate lies next above mica-slate, and has some remains of unknown corallines and shells.

Then old red sand-stone, and the conglomerate with clay-slate, called greywacke. These contain vegetable remains of unknown genera, with 67 species of zoophytes, 48 of crustacea, 88 of conchifera, and 82 of mollusca, &c. but no quadrupeds.

Above these are the coal-strata and their alternations of sand-stone and slate; clay, and sometimes lime-stone and clay; iron-stone, with dykes of green-stone and basalt.

Above the coal measures lie the new red sand-stone formations:—1. In red conglomerate. 2. In magnesian lime-stone. 3. Variegated sand-stone. 4. Muschelkalk; and 5. Uppermost, Variegated marl. The petrifactions of vegetables, zoophytes, crustacea, fishes, and fresh water-shells, are numerous, and the impressions of birds'-claws and reptiles are found.

The great oolitic formation comes next, and is in 3 divisions separated by lias lime-stone lying on the new red sand-stone, by Oxford clay and Kimmeridge clay, with occasional coal-measures. The Lias is a mixture of lime-stone with clay, and it contains the first appearance of quadrupeds in lizards of great size, as the ichthyosaurus, plesiosaurus, megalosaurus, turtles, an opossum, insects, shells, fishes, crocodiles, &c. &c.

We then rise to the green-sand and chalk formations, the uppermost of the secondary formations. The sand is indurated as stone, and in it are found fossil crocodiles, alligators, and other amphibia, with bones of a bird. Above this lies the chalk stratum, with petrifactions of fishes, shells, &c. &c.

In the tertiary period above the chalk, which commenced, by estimation, about 94,500 years since, we find the same proportions of plants as on our diluvium, but the species, for the most part, are different; and their localities have progressed towards the Equator. Cocoa-nuts and palm-fruit are found in London clay and Sheppy.

The upper old formations contain the larger animals, and the alluvial and newest strata subjects with which we are familiar.

Diluvial rocks contain elephants, &c. Those in the oldest rocks, as lime-stone and slate, are chiefly mollusca, as corals, ammonites, nautilites, &c. while vegetables seldom occur, except reeds and ferns.

The older secondary rocks contain peculiar aquatic plants and reeds, then above these madrepores, corals, &c. all fixed where they lived; then shell-fish, very simple, but differing from all now in existence; in strata above these, fishes, bamboos, and ferns; in a still higher stratum are more complicate shells and oviparous amphibia, as crocodiles, tortoises, and reptiles, these are embedded in the uppermost solid rocks of the oldest secondary formation.

In the newest solid rock formations, whales, seals, and birds, appear; above these, land animals of enormous size, birds and fresh-water shells, all in concrete rocks.

Above these, in the lowest beds of loose soil and peat bogs, elephants, elks, rhinoceroses, of peculiar species, are found. Near the surface the remains of the existing races.

The age of reptiles was that in which the secondary strata were formed. The age of extinct mammalia begins with the more recent tertiary strata; and of man, and living species, in the most recent of them.

The secondary strata contained no mammalia, but little marsupial animals, with the maternal habits of the opossum. The earth, however, then abounded with reptiles and gigantic lizards, some of which had wings. It afforded but slight traces of coal, at least in Europe.

The past destruction of species is evidence of like effects in future, if the universal spread of species by the arts of man is not a security; but even this depends on the continuity of races which may be silently terminable without overwhelming convulsions.

Much has been done in geology in all parts of the world, but as subterranean discoveries are accidental, and of the 199 millions of square miles on the surface, not 9 have been explored to the depth of 100 feet, it must be another century ere the true History of the Earth can be correctly developed. Pompeii is not the only city which will be disentombed; and we have many errors and false theories to dispel before truth will be discovered, and many sinister influences to combat, before it will be generally recognized.

In the gradual developements of a planet, certain combinations would produce exhausting effects; hence, materials of combustion would be diminished, and internal fires be fewer now than anciently. This will account for trap, basalt, and other igneous rocks created in the age of fire. But it does not seem necessary to suppose that all mountains were of igneous origin, and uplifted by forces from beneath. A perfect smooth plain surface is incompatible with the economy of nature, in rains, rivers, &c. &c. The external signs would be the same, in upheaving and in laying on the debris.

The whole genus of hard brittle substances is produced as varied effects of the aqueous solution of finely-divided silex, in combination with bases which contain various proportions of alkali.

Filtration also varies its products according to the density of the solution. So silicious or mixed solutions, exposed to electrical action, generate crystals, gems, &c. Even a stratum of diamonds may be the mere product of a peculiar infiltration. No agent is more definite, and more constant and universal in its action than infiltration, and the consequent impregnation of all porous bodies with which the siliceous or calcareous solution comes in contact.

When the aqueous matter of stalactites evaporates in caves, &c. it produces stalactites; but when the same matter descends among and through masses of earths and or-

ganized bodies, we then seem, in long time, to get certain hard stones, as agates, flints, &c. and petrifactions of all kinds. The cement of pudding-stone is one palpable case, and if this cement had descended into a vacant space, it would have produced transparent stalactites, stagmalites, or spars.

Conglomerate consists of fragments of primary rocks held firmly together by siliceous cement, and lying as a transition stratum, with old red sand-stone, below the coal formations. When it is uppermost there is no coal. The forests which formed the coal-beds grew in the sand and shale, whose filtration formed the cement of the conglomerate.

In a chip of pudding-stone of half a lb., there are fragments of 5 or 6 rounded agate pebbles, and some hundred pieces, and minor stones which also have been rounded. The cement of the whole is harder even than the agate or flint, for these split in all proportions, instead of leaving the bed of the cement. In 100, on a surface of 4 inches diameter, every stone and fragment has split rather than separate, and one only, of the size of a coffee-berry, stood proud in its rounded form, and had broke out from the opposite bed of cement.

Agate-stones are wavy, and chip in brittle wavy laminæ, so that even these appear to be gradual composts of other ruins. Each of them is penetrated, from the eighth to the fourth of an inch, by a flinty colour all round, having the agate in the centre, and more flint than agate. It is difficult to determine whether the flinty coating is an accretion, or a conversion of agate substance to flint substance.

Every pebble is but a fragment of a larger mass; and its surface is smooth and rounded by attrition. "I follow (says Mantell) the stream in which I find it to its source, half-way up the hill, and find that the waters issue from a bed of clay and gravel, forming the eminence on which I am standing. From this accumulation of flints our pebble has evidently been removed by the torrent, and carried down to the spot where it attracted notice. The bed of stones on the summit of this hill is clearly but an accumulation of water-worn materials—an ancient sea-beach—consisting of chalk-flints, that have been detached from their parent bed, and broken and rounded, and heaped together; and we are certain of this, because we know that flints cannot grow; and, upon inspecting the specimen minutely, we are certain that it was formed in *chalk*, for it contains impressions of shells and corals, which are found only in that rock. This flint, now so hard and unyielding, was once, therefore, soft or fluid, for we have the delicate markings of the sea-hedgehog *(echinite)* impressed on its surface, and discover a fragile shell, covered with spines; nay, more, upon breaking off one end, we perceive that a sponge, or some analogous marine production, is enveloped in the substance of the flint; and also that there are several minute corals, with here and there scales of fishes."

Chalk abounds in marine shells, corals, and the remains of fishes, crabs, lobsters, and reptiles, all of which differ essentially from living species, although a few of them resemble, in some particulars, certain corals and shells of the seas of hot climates. These remains are found in so perfect a state—the shells with all their spines and delicate processes, and the fishes with their forms almost entire—that no doubt can be entertained that these animals were not only surrounded by the chalk while living in their native seas, but also that they were entombed in their stony sepulchres suddenly, and while the chalk was in a state of fluidity.

Flint occurs in chalk in various forms; sometimes in nodules, or irregularly-formed globular masses; sometimes in continuous layers or veins, either horizontal or oblique; and the nodules have generally shells, corals, or zoophites, as nuclei, while the veins fill up fissures in the chalk rock. The chalk is stratified, or separated into layers, as if a certain quantity had been poured out, and had sunk to the bottom of the sea, and enveloped the animals which fell in its way, and this layer had become consolidated before a fresh mass was superposed.

The organic bodies served as centres, to which the siliceous particles attached themselves, and hence we often find a shell or a fish, partly imbedded in the chalk, and partly in flint. We know also that the chalk (at least of the south of England) was not only deposited in a sea, but in the basin of a very deep sea, for the Ammonites, or snake-stones, which, like the recent Nautili, were inhabitants of deep waters, abound in the chalk. These shells, which are only known in a fossil state, were very abundant in the ancient oceans of our globe; those of Whitby are well known.

Our flint, then, we perceive, was once a fluid, poured into a deep ocean inhabited by countless beings, none of the species of which are now known to exist; it then became consolidated, and invested by the chalk, entangling the shells, corals, and other remains, which we find embedded therein.

The incessant dashing of waves against the base of chalk cliffs, undermines the rock, and huge masses fall into the waters. The chalk then becomes softened, and finally is transported to tranquil depths of the ocean, where it forms new deposits, and the flints being detached, are broken and rolled by attrition into pebbles and gravel, and ultimately sand.—*Mantell.*

Lyall states that our carboniferous rocks are older than any other land, but that taking away the marine strata the primary mountains only would remain. Calcareous rocks with fossils, like those in our transition and mountain limestone, extend over great part of Europe and North America.

The beds of sandstone covering some of the coal-beds, are 228 feet thick, indicative of the vast force, or long duration of forces, which covered woods with such volumes, which as sand must have been much greater.

Sand-stone consists of grains of quartz

and mica, while the felspar (the other constituent of granite) is in clay. It also contains nodules of slate-clay, or carbonate of iron, and pieces of wood as coal. It lies in distinct strata of all thicknesses, as though laid on by tides and inundations. Slate-clay is in thin beds, with mica and sand-stone.

The Silurian system of transition rocks contain 5 or 6 species. The old red sand-stone 20. The coal measures 54. The magnesian lime-stone 16. The oolitic series, from the lias to the wealden, 150. Green sand and chalk 50. London clay above 50, and crag 5 or 6. Remains of the *gyrostres mirabalis*, the large known fish, have been found at Whitby.

Sedgwick divides the new red sand-stone of England into 7 members of sand-stones, lime-stones, and marls. Werner placed the old red sand-stone above the coal, but we place it below the coal.

Tertiary strata lie on chalk, the uppermost of secondary, and consists of clay and sand. They appear to be accumulations from tidal action, with more fossils than secondary, and of different genera or floetz.

The microscope has lately shewn that the whole mass of chalk strata is composed either of marine insects or of their remains, a fact often asserted, and generally believed, but now made evident to sight.

Chalk is covered not only with clay and sand, but with very large water-worn *boulders* of foreign rocks, containing fossil remains, which indicate that they were carried some hundred miles from the N. and W. to their present sites, during the last submersion. Abraded chalk turns up 48 bushels of flints to the acre, every four years.

Coal strata lie between the lower and upper red sandstones.

The coal measures vary from a few inches to 80 feet, and alternate with the others, so that coal-fields contain from 30 to 80 coal strata, more of sandstone, and many of limestone and slate-clay. The whole, as far as dug, are from 4000 to 4500 feet thick.

The lowest coal-bed in Yorkshire lies on the millstone-grit; the series between the flagstone and grit is from 120 to 150 yards, and extends from Halifax to Sheffield. It contains not only plants and fresh-water shells, but marine shells of the genera pecten, and ammonites and orthocera, ostrea, and scaly fish. It is the only coal-bed so furnished, and the same strata also contain muscle bands above and below the pectens.

All the coal-beds are wood and vegetables, palpably buried by the superincumbent strata of sandstone, &c. which forests must have been ages in accumulating, and the covering must have been brought by the ocean in periods like the return of the perihelion, so that a mean of 60 coal-beds would employ 60 × 21,000 years, or 1,260,000 years.

Porphyries cover many of coal formations. In the coal strata of Dalmarnock, 500 feet below the surface, a petrified fly has been found on the stem of the *calamites dubias*.

The Durham and Northumberland coal-fields extend from South Shields to Castle Eden, 21 miles, and westward 32 miles to West Auckland. Thence to Eltringham 33 miles, and to Shields 32; in all 594 square miles. There is another breadth of 9 miles by 27, from Shields northward, making 243 miles.

Above these are the ruins, or a solution of the preceding, forming the diluvial, alluvial, or uppermost system, and filled with remains similar to those which now live; but often of species extinct, or of greater numbers than now occupy the same countries.

It is generally considered that all that lies above the crystalline granite is formed out of its parts which are quartz, mica and felspar so intermingled as to produce the silex, clay, lime, and magnesia of the upper strata.

Oxide of iron, or iron-rust contained in the mica of the granite, mingles more or less with all earthy substances, and changes their colour and structure.

The strata above these are composed of the ruins of the primitive rocks, and they contain remains of vegetables, fish, and animals, of species different from those now in existence. Hence they are called *transition* rocks.

The horizontal beds above these, called *floetz* rocks, belong to the transition series, since they contain fossil remains, not of existing species.

The internal heat has created, in time, many changes not cognizable by brief observation, or chemical manipulations.

The following are the General Conclusions of Mr. W. Phillips:—

1. The *lowest and most level* parts of the earth consist of horizontal strata, composed of various substances, many of them containing marine productions.

2. *Similar strata* are found *in hills* to a great height.

3. Shells are sometimes so numerous as to constitute an entire stratum.

4. Shells are found in elevations *far above the level of the sea*, and at heights to which the sea could not be raised by existing causes.

5. These shells once lived in the sea, and were deposited by it.

6. Shells continue to be found as we rise to the foot of *great chains of mountains*.

7. At this elevation the strata, instead of being horizontal, as in plains, have various inclinations, and are sometimes vertical.

8. From these and other circumstances, it is inferred that there have been frequent irruptions and retreats of the sea.

9. As we approach the *summits of lofty mountains*, the remains of marine animals and shells become rare, and disappear.

Geography and Localities.

The old continent may be considered as having for its nucleus, or rest, an immense chain of mountains, which stretches 8000 miles from east to west, under various names. In Europe it bears the name of Pyrenees, Alps, &c. and in Asia, Caucasus, Himalaya, and Thibet, and Tartary, till it

reaches the Pacific Ocean. Atlas is part of this ridge; and Etna and the Greek mountains are branches of the general chain. The heights are various; or in Europe, from 5 to 15,000 feet, and in Asia from 10 to 28,000. This ridge then determines the general form of the continent, and the course of the rivers. Some call it the spine of Europe and Asia; while the Andes, in America, are called the backbone of that continent.

The countries to the north and south are governed in their elevation by their connection with this great chain; some are its valleys, and others are table-lands or steppes, all sustaining different levels from the sea. Italy is merely the declivities of the Appennines, and Barbary of the Atlas chain. Bohemia is a circular valley, and Hungary another. Asia Minor is an elevated plateau; Persia is also a high plateau, depressed in the middle; Thibet is a vast plateau, more extensive and more elevated, sustained on one side by the Himalayas, and on the north by the Altai mountains, both 20,000 feet high, while the immense plateau is 9000 feet. The tract northward of the mountain chain is a vast plain, which includes England, France, Holland, Germany, and Russia to the Ural chain.

The leading features in the geological structure of America are: 1st. the continuous belt of high mountains and plateaux traversing its western border, from Behring's Straits to Terra del Fuego, forming the most uninterrupted extent of primitive mountains known. Their northern portion, consisting of the Rocky mountains, appears to be chiefly granitic, while, in the Cordilleras of Mexico, and the Andes of South America, the primitive strata are, for the most part, covered with immense accumulations of transition porphyries, trachytes, and lavas, forming numerous volcanoes, many of which are in constant activity. 2dly. The wide expanse of low and generally plain country, that succeeds immediately on the west to the above-mentioned zone of mountains, and through which, in both hemispheres, flow some of the most magnificent streams in the world. This region consists of immense deposits of newer rocks, over which is strewed every where, as with a mantle, the alluvial formation, or a covering of sand and gravel, with which are intermingled rolled masses of rocks. 3dly. The chain of mountains of lower elevation and inferior continuity, which forms the eastern boundary to the low country, and whose principal masses and highest points are composed of granite. 4thly. The clusters of islands occupying the seas between North and South America, which are, almost without exception, of a volcanic origin.

According to a late scientific traveller, the coasts of New Holland present, to the geological eye, many features of curiosity. There are the same ruins of former surfaces in the strata, fossil remains, fossil woods, coal strata, with all their characteristic vegetation, ironstone, fullers' earth, &c. Mr. Wilson reports fires in the cliffs, resembling that near Lyme.

South of the great chain of the old Continent, the deserts of Africa and Arabia and the plains of India present themselves; and the rivers Indus, Ganges, &c. fall with the land towards the Indian Ocean.

Asia is palpably the preponderating mass. The axis of rotation equalizes the whole, or reduces various inequalities to one. The pole of the earth, therefore, respects Asia, and the pole of the orbit is on the contrary side as to Asia. Their distance is 23½°, but constantly decreasing, because the Asiatic mountains are constantly spreading over the plains, and adjoining seas.

Central Asia is an immense Table Land, terminated in the north by the Altaic chain, highest 100° east, and in the south by the Himalayas, and both are connected by the Belur-Tag range, east of which is the deserts of the Monguls, and west those of the Tartars.

The north Polar Regions consist chiefly of primitive and transition rocks, with few secondary and alluvial, no volcanic, and slight tertiary strata. Coal of the oldest formation was found at Melville Island: also tree-ferns and fossil corals, with fossil dicotyledonous woods in Baffin's Bay, &c. Iron ores, copper ore, and graphite; garnets, rock-crystal, beryl, and zircon, were also found.

There are no solid rocks in the Arctic Regions, owing to the severe frosts.

Above two-thirds of the surface of Modern Europe are covered with remains of aquatic animals, &c. in tertiary strata, proving submergence.

Bears, dogs, foxes, and wolves, are found in diluvial soils and caves; hyenas and tigers in lime-stone caves and marl; the teeth of horses, elephants, rhinoceroses, hyenas, bears, wolves, tigers, &c. are found in masses in diluvial soils; oxen in peat bogs in several countries; deer and elks in peat bogs and marl pits; one six feet high and nine feet long was found in the Isle of Man, in marl, covered with sand, then the peat, and the vegetable soil.

Rhinoceroses are found in every part of Europe, and in the arctic circle; the hippopotamus is found in England, France, &c.

Mount Balca, near Verona, presents the most numerous specimens in Oryctology, which have yet been found in one place. Bones of elephants, stags, bears, and phocæ, 200 genera of unknown testacea—200 species of petrified shells, belonging to different modern seas and climates, with zoophytes of different genera; and remains of birds and insects are found in immense masses; basaltic columns, scoriæ, lava, &c. appear, the whole proving that fire and water have operated in remote ages. The remains of land-animals are not more remarkable at Mount Balca than those of marine production, for the fishes of all modern seas and rivers are embedded in the calcareous quarries, a sort of marly schist of a light grey

colour, affording a fœtid odour like putrefaction. In general, they are perfect, and not mere impressions. There have been ninety-four species found, one three feet in length, and a young shark, with its food undigested in the stomach, and another fish had one half swallowed in its throat.

The cave at Liege presents different layers of staglamite with exuviæ in each, indicating a series of geological epochs.

It is a feature of these caves, which the theory of dens does not solve, that the rocks which form the sides, &c. of the caves have similar bones imbedded in their substance. We might, hence, conclude that water had passed through the caves, and then, having carried off the earthy part of the rocks, had left the insoluble bones.

Christol has discovered two caves, containing bones in the department of Garde; others have been found at Bayreath, Bize, Plymouth, the Mendips, &c.

The *sterile* parts of Great Britain are Cornwall, North Devon, North Wales, Cumberland, South West Scotland, and the Grampians full of primary and transitive rocks. The *manufacturing* parts are from the Exe to the Tyne, through the Western midland counties, whose base is new red sandstone with mines of coal and iron. The agricultural parts are from Dorset to Scarborough, over plains of oolite, limestone, and chalk, without mine or coals. From Lyme Regis to Whitby is on the lias formation, and from Weymouth to Hull on the Oxford clay. From N. E. to S. W. the out crops of the strata are in lines from S. E. to N. W., and the road crosses them in breadth. Between Newhaven, S. E., and Whitehaven, N. W., there are 70 changes in 350 miles.

The diluvial remains of England indicate a current of the sea from the northward. The Thames is charged with pebbles from the Licky Hill, near Birmingham.

The bones of apparent birds, found at Stonesfield, &c. are pterodactyles, or extinct species of flying reptiles.

Ink bags, like those in the cuttle-fish, are found in the lias at Lyme.

The bezoar stones, found at Lyme, in lias, are the fæces of the ichthyosaurus.

Sharks' teeth and fishes' teeth abound in Oxfordshire.

The plains of Middlesex are covered with enormous accumulations of water worn debris, chiefly of chalk flints, often abounding in remains of elephants, hippopotami, &c.

Elephants' bones have been found in diluvial strata, in nearly every county of England and Wales. Never in the older strata, and not in the modern alluvial soils. Europe and Northern Asia equally abound in them, as well as in those of the rhinoceros, tiger, hippopotamus, &c. &c.

The strata near Reading consists of a deep bed of clay, three feet of coarse fullers' earth, four feet of green sand, one and a half foot of sandy clay, two feet of oyster-shells, one foot of sandy clay, thirty feet of chalk, and a bed of flint. In other places, fossil-shells, sharks'-teeth, and remains of fish, are found; and in others, bones of animals, and remains of birch-trees.

Fossil tropical remains are found in our coal measures at great depths below the present surface.

The reptiles and vegetables of Sussex, says Dr. Mantell, must have been inhabitants of a country enjoying a much higher temperature than any part of Europe; and the former, from their enormous magnitude and osteological characters, clearly belong to an order of beings, of which the present state of the earth affords no example. The epoch of their existence may be termed THE AGE OF REPTILES.

The broken and rolled state of the greater part of the bones, the pebbles, and the conglomeritic character of many of the deposits, prove that the strata were formed in the bed of a river, or an estuary.

The Hastings, or Tilgate strata, must have been formed and consolidated before the chalk (which rests upon and once covered them,) was deposited. After the Hastings' beds were formed, they must have been submerged beneath the ocean which formed the chalk; for the latter contains nothing but marine remains, and not one fossil of the Hastings' beds.

The ocean of the chalk, in its turn, must have passed away, and the consolidated chalk have been covered by the waters which deposited the tertiary strata, for the latter contain fossils entirely distinct from those of the chalk.

The tertiary, in common with the chalk and Hastings' beds, must have been subsequently broken up, and the wealds of Kent and Sussex formed, and the chalk dislocated and separated; the lateral fissures in the chalk now constituting the vallies through which the existing rivers flow. To this epoch may probably also be referred the formation of the beds of diluvium.

There have been discovered in these strata of Sussex, exclusively of the organic contents of the modern alluvial deposits, the remains of nearly four hundred species of animals and vegetables.—Mammalia, 5. Birds, one or more. Reptiles, 12. Fishes, 24. Testaceous Mollusca, 260, of which 21 are fresh-water. Annulose Animals, 11. Radiated Animals, 29. Zoophytes, 27. Vegetables, 15.

At Chadderton, near Manchester, a human thigh, leg, and foot, converted into sand stone, have been found in coal strata at 100 yards depth.

On the shores of the Mersey, at Liverpool, at nineteen feet, was found fine sea-sand; then a firm bluish marl, intermixed with lichen, fibres, and leaves; then branches of trees; then trunks and roots of oaks, firs, &c.; then marl, and at thirty feet a pair of stag's horns; then black peat, with nut-shells, fibres of timber, &c. a foot thick, resting on the rock forty feet below the quay, and twenty below the level of the pool.

The rocks on all the western coasts of Great Britain, with two or three exceptions of coal measures, are primary or transition,

with occasional trap and basaltic rocks and transition conglomerated. But on the eastern coast and southern to Tynemouth secondary rocks or upper formations, nearer the surface only are found, as new red sandstone, compact limestone, lias or greyish limestone, oolite or yellowish limestone, endurated clay, sand, and, in certain cliffs on the English coast, of chalk, overlaid by tertiary limestone, sand, and clay.

In the interior of Norfolk is a bed of oyster shells, 9 miles long and above 18 feet thick. Other shells and bones (some of elephants, &c.) also abound 100 feet above the sea-level. Alder and hazel bushes are found 20 feet below the surface-level. Remains of extensive forests are traced beyond the mouth of the Wash and under the land, with bones of elephants, oxen, and deer. The same forests are found on the opposite coast of Flanders, and it is believed that they once joined.

In the north of England, Forster states that there are 32 beds of coal, intermixed with 62 of sandstone, 17 of limestone with marine remains. 128 of shale and clay with iron ore, and 1 of trap. The others contain land shells, &c. indicating alternations like the submersion and retreats of the sea.

South Britain consists of primary rocks in the west, of secondary down to coal measures in the centre, with upper secondary and tertiary on the south-eastern sides.

Granite extends from Cornwall to Dartmouth, and there is a granite rock at Mountsorrel.

The steepest sides of strata in England are to the W. and N. W.—*Stukeby*.

Coal measures in the south of England are above the mountain limestone; but in the north the limestone is broken into sandstone and partial coal strata.

The Isle of Wight and part of Dorsetshire exhibit signs of disruption.

Salisbury Plain is 22 miles by 15, 4 or 500 feet above the level of the sea, and a chalk and limestone formation with little soil.

The detritus in districts which border Wales, is laid by currents N. W. to S. E. except when varied by the direction of mountain ranges. In Lancashire, Cheshire, and Shropshire, blocks of granite, porphyry, and greenstone, have been carried by currents from the mountains of Cumberland and imbedded in the sand and gravel of adjacent formations, but more on the north than the south of high lands.

Sea shells and gravel are found 1000 feet above the sea-level in Caernarvonshire.

The Welsh and Cumberland mountains are primary formations, consisting of slate, clay slate, felspar, porphyry, and greywacke. They are bounded in Shropshire, Monmouthshire, &c. by old red sandstone and transition limestone, and the Silurian district has beds 7000 feet thick of old red sandstone, schist, freestone, and limestone.

In Wales the geological lowermost are on the surface uppermost, and in England the uppermost in Wales are covered by transition, carboneous, secondary and tertiary strata. South Wales is an immense basin 100 miles by 20

Wales was anciently separated by an arm of the sea from the Bristol Channel to the estuary of the Dee and Mersey, on which line the salt strata are now found.

The salt-pits at Northwich are 2 miles round, intersected by avenues 70 or 80 feet wide, supported by pillars of salt 20 feet square. The depth is 112 yards, and the general temperature 55°.

Human bones and skulls have been found in a lime-stone cave at Cheddar 30 feet deep, beneath bones of boars, oxen, &c. Other human bones, with pottery, have also been found in a cavern in the South of France, mingled with those of the rhinoceros and elephant.

Richborough near Sandwich, now 2 miles in the sea, was once a castle and port at the mouth of the strait, which once separated Thanet. Another Roman port off Romney Marsh is now several miles out at sea.

Besides the immense cliffs near Tunbridge Wells, there are others still more extensive on the east of the Linfield Road to Brighton. They are ocular proofs of tidal action, and of the presence of the sea in the interior of Sussex, countless ages ago.

In boring an artesian well at Mortlake, the gravel was 20 feet, the London clay 240, plastic sand and clays 55, hard chalk and flints 35, and soft chalk 15.—Total 365 feet The water then overflowed. Cost £300.

Lyall thinks there existed an extensive archipelago in the northern hemisphere.

Lizards found at Stonesfield must have been forty feet long, and eight feet high! Fossil fishes occur every where, and in all forms. Crabs are numerous, as well as other shell-fish.

Bones of several elephants, of a rhinoceros, &c. have been found near Ilford.

Granite appears in 2 or 3 places in Cumberland, &c., and the species at Shap are found in large boulders through Lancashire and Yorkshire.

Cross Fell is of lime-stone, capped by coal strata. The Cheviot hills are porphyry projecting through the upper strata. The Isle of Man, the Shetland and Orkneys are primary, and Orkney displays the power of water to move, split, and break up rocks.

The Malvern hills are granite and sienite. Charwood is sienite, porphyry, trap, and slate. The Wreken, &c. are greenstone, amygdaloid, and claystone.

The tertiary stratum of dark London clay, containing sulphurate of iron, and sulphate of magnesia, is from 250 to 350 feet thick, and was a deposit in a former estuary, which extended from Sheppy to Reading, called the London Basin, and abounding in fossils.

Scotland consists of primary rocks below the coal measures and of transition rocks. The line of demarcation shows that the efficient forces proceeded from the North-west or Atlantic, for it lies across the country from South-west to North-east, *i. e.* from the Clyde to Caithness. North of this line, we have all the primary strata up to old red

sand-stone; south of it the transition courses, topped by coal measures and new red sand-stone, but little of the superior secondary, and scarcely any of the tertiary. The mountains and the islands range in the same direction, and all primary, the islands being marine mountains of gneiss mixed with other primaries. The lochs and indentations are also in the same direction, South-west to North-east. Skye, Mull, &c. are a groupe of gneiss, trap, with basaltic islands, near Staffa, which contains Fingal's cave, &c.

The South-western division of Scotland is separated from primitive and transition division, and by the upper transition of conglomerate and old red sandstone; and above the lia coal measures and mineral products of value. The coal-fields extend 20 miles in breadth, from the Clyde to the Forth, and, as might be expected, are more accessible on the latter, where coal-works cover an area of 80 square miles, and in some places have measures of 40 feet. They sustain iron smelting to the amount of 70 000 tons per annum.

Arran is divided like the main land, by a line South-west to North-east; the latter having granite mountains of vast heighth, and the latter of transition and coal-shales.

Basalt is distributed in patches all over Scotland, and yet there are no signs of volcanoes, &c. In fact, the recent determination of great internal heat renders it probable that most igneous rocks are products of that heat, and bared or turned up by marine inundations.

On the descent of an excavated sand-stone-rock, near Lochmaben, then soft, there were found, for forty or fifty yards, four tracts of animals, distinctly marked in uninterrupted continuity, with regular alternations of right and left foot, and the heel and toes; supposed in one case to be the tortoise or crocodile: and the most distinct were on rocks sixty or seventy feet below the modern surface.

Shell-marl, in Scotland, contains skeletons (in numbers as named,) of stags, oxen, swine, sheep, dogs, hares, foxes, wolves, and cats. Beavers are scarce.

The coasts of all Ireland are alpine and primitive, and the Midland a full third are secondary limestone, but hilly, without tertiary.

Opposed to the alpine coasts of Wales and Cumberland, stand the alpine eastern coasts of Ireland, and, as the western coasts of Ireland are also alpine and primary, we seem warranted in the inference that the Irish Sea was once a valley between the Irish and Welsh ranges, and the Irish Channel an irruption in a limestone plan like that which constitutes the central counties of Ireland. Further to the South-west, between Ireland and the Azores, in a milder climate, may have lain the Atalantes of Plato.

The bogs are ascribed to the prevalence of shallow lakes, which promote the growth of mosses and aquatic plants. The turf is the universal fuel of the poor.

In Antrim, the secondary formations are covered with massive beds of basalt to an extent of 800 square miles, and above 500 feet deep, (even 1500 in some parts,) covering 10 or 1200 feet of chalk, green sand, lias and red marl, and in some places on the coal formations, fissures are also filled with basalt. All this basalt in Ireland, and under the sea to the Scotch coasts, are ascribed to the conversion of lava ejected from some ancient volcano, probably submarine, during the geological age which followed the formations on which the basalt is placed. The secondary formations beneath contain their usual fossils, and the basalt and the basaltic columns rise in sets one above the other to the number of 16, of which 6 are columnar. At Fair they shew themselves through an elevation of 500 feet, and some of the shafts are 150 feet high and 5 broad, in pentagons, hexagons, and octagons. At the Giant's Causeway they are 30 feet high, and a foot broad. The constituent parts are felspar and hornblende.

An extensive formation of *basalt* exists nearly in the same line of longitude, from the Canary and Madeira islands to Ireland, Scotland, the Hebrides, and Iceland. Few countries in the world present such magnificent basaltic rocks as the north part of Ireland, and some of the Hebrides: probably these are connected under the ocean.

The Giant's Causeway constitutes a small part of a vast basaltic range in the county of Antrim, along the north coast of Ireland. The promontory of Fairhead and Borge, in the same range, are situated eight miles distant, and consist of various ranges of pillars and horizontal strata, rising from the sea to the height of 500 feet. Many of the columns in the ranges of Fairhead are 130 feet high, and five feet broad. At the Giant's Causeway, the columns seldom exceed one foot in breadth, and thirty feet in heighth; they are sharply defined, and are divided into small blocks, or prisms, a foot or more in length, fitted into each other, like a ball and socket. The basalt is close grained, but the upper joint is cellular. The columns are mostly formed with five or six sides; but some have seven or eight, and others only three. The cave of Staffa is made by the destruction of basaltic pillars by the sea. It is nearly 400 feet long, and 35 broad.

There are in many bogs 3 separated strata or layers of large trees, separated by 10 or 12 feet of turf and heath. A carbonizing process gives them the appearance of being burnt. Under the bogs are beds of marl, and beneath clay and gravel. The turf is *sphagnum palustre*.

The bogs of Ireland cover 2,830,000 acres, to the depth of 5, 12, and even 30 feet.

The transition mountains near Killarney rise above 3000 feet, and one to 3400.

The anthracite coal of Killarney contains the same vegetable fossils as our coal beds.

The bones of an elk preserved at Dublin, and found in the bogs, have a spine 10 feet 10 inches, with a heighth from the foot to the top of the horn of 10 feet 4. Each horn

is 5 feet 9 in., and the distance of the tops 11 feet 10 in.

France, geologically, consists of 5 basins, the Garonne, the Loire, the Seine, the Rhine, and the Rhone.

The district near Paris lies over the chalk beds, and it was on the gypsum of this tertiary series that Cuvier and Brogniart discovered so many remarkable fossils, viz. 78 species of quadrupeds, 4 5ths mammalia.

Italy consists of a central calcareous chain, highly inclined, flanked to the sea with strata, nearly horizontal, and obviously deposited by the seas on each side. The Alps are similar, central, and flanked by tertiary deposits, to the heighth of 2, 3, or 4000 feet, and containing some existing animals. Parts of Piedmont are sea-sand with a strata of shells beneath.

The desert belt of sand extends from the Atlantic across Africa into Arabia and Persia, even beyond the Indus. Its breadth is from 400 to 100 miles.

Limestone is the substratum of all the soil of Egypt. The Deserts are quartz and silex.

All the hills which waste Nor hern Africa are calcareous, and filled with shells, &c. to the heighth of 1500 feet. The Gulf of Syrtis is a gradual retreat of the sea from the interior, where beds of salt and mines of rock-salt are abundant.

It has been suggested that, as the Deserts extend in a line to the Gulf of Syrtis, this gulf may have been the opening of an African sea which once covered all the deserts of that continent. Flakes of salt, sea-shells, and putrified fishes, are found every where in these deserts, and the clifts and sides of the hills are full of marine remains.

The sand-banks in the German Ocean are one-fifth its area. The Dogger-Bank is 350 miles long, of quartz sand, with shells, &c.

There is a tradition in Cornwall of the submersion of the Lionesse, a tract extending to the Scilly Islands.

St. Bride's bay was once a flourishing province of Wales, called Gwaelod.

The west coast of Greenland sinks or the sea rises.

Calcareous water near Messina turns sand into mill-stones in a few years, and in all Derbyshire, Iceland, and Lough Neagh incrustations have the same origin.

Tabrez marble is formed by some springs near Maragha, in Persia. The water overflows a basin, and in spreading round in small lakes is clear, thick, black, and then white as if frozen. A section is like sheets of paper in layers, and finally it forms strong marble, on which persons may walk.

Between Mosul and Bagdad, Buckingham saw cliffs of pudding-stone, and rounded pebbles, embedded in lime-stone like walls.

Lesson conceives that the Sunda, Molucca, and Philippine Islands, with New Guinea, the New Hebrides, &c. were part of a great submersed Austral Continent. He describes them as primitive formations like the tops of mountain ranges. Other islands in the South Sea are volcanic, madraporic, or coralline, and comparatively recent. The vegetation of the former is splendid, and of the latter borrowed.

Cape Horn is one mass of black rock, without vegetation or birds.

The richest district at the Cape is a grey clay, very shallow, lying on clay slate. In consequence, its products do not accord with its climate. The rivers are mere torrents, and the coast is inaccessible by surf. It exhibits proofs of the theory of alternations of the seas in both hemispheres. Both it and Southern America resemble, for human purposes, the tops of elevated land.

Chili has wood-mines, not coal, composed of immense prostrate forests covered with sand in districts without trees. We might imagine that they were the forests of plains now covered with the ocean, and transported to those high lands of the hemisphere.

Teheran stands on an alluvial plain, and deposits of the same age form low hills and valleys. Below Sheergâh, the country, as far as the Caspian, is an alluvial, muddy flat; and along the shores are innumerable trunks of large trees, which had been drifted down by the rivers. The sea is filling up.

Melville Island is floetz sand-stone over coal and iron-stone; and the sand-stone contains remains of arborescent ferns, with impressions of stems of an incrinus and a striated reed. Jameson concludes that forests once grew there, while corals indicate a climate adapted to *polyparia*.

Fossil Vegetables.

Silicified petrifactions preserve the most delicate ramifications of fibres and parts, so as to admit the highest powers of the microscope. The conversion has been ascribed to infiltration of water imbued with siliceous atoms which are deposited; but, it is conceived by others, to be connected with compositions of silex and alkali, which, under certain circumstances, produce glass, &c.

Shells, bones, teeth, and various vegetables are scarcely altered. In other cases, their impressions remain on the stones; but more commonly they are incorporated with the stone.

Fossil remains are found at great heighths and depths, because an increase of the obliquity gave greater effect to the Perihelion force, and because the greater rise of the sea in one hemisphere exposed lower land in the other hemisphere, like spring-tides.

The *fossil* species, distinct from living species, are, mammalia 120, birds 25, amphibia 50, fishes 250, and mollusca 3100; in all, 4645, besides vegetables.

There are now 50,000 species of fossils recognized, but they are believed to be of very distant epochs.—*Lyall.*

The first germs of vegetation would, in a perihelion period, not exceed the byssus, or moss forms in air, but the active density of water would evolve others and transfer them to the land. Local organizations would thus extend their varieties, and abstract pabulum from the soil in reaction with atmospheric elements. Forms for locomotion, carrying their soil in the stomach, seem

to have arisen in animalculæ as germs, in the monus, the hydatid, the polypi, &c. &c., which each perihelion period would vary and extend, oxygen and its correlatives being the agents and patients. Each perihelion period would form the marine varieties, and, after several periods, the principles of tt formation would appear, which we find in the upper transition series, progressing through the secondary and tertiary.

Brogniart, in his Geological Flora, classes *plants* into four periods: 1, The transition and coal formations; 2, Variegated sandstone; 3, The chalk; and 4, Above the chalk. He conceives that the successive creations are distinguished by a sudden change in the essential characteristics. Those of the fourth period are similar to the present. Below the chalk the most perfect are the *cycadeæ* and *coniferæ*. A land vegetation marks each period, while one family of one period runs into another. The dicotyledonous begin in the oldest strata of the secondary, and increase in the more recent.

The 300 fossil plants in, and below the coal measures, are mostly ferns, equisetaceæ, and coniferæ. The second are ferns, cycadeæ, and coniferæ. The third resembles the living genera of sea-weeds, ferns, lycopodiaceæ, equisetaceæ, cycadeæ, and those of all periods, the coniferæ and palms.

The most ancient Flora consisted of vascular cryptogamia of large size. The second of smaller size with cycadees, &c., and the third of all the vegetables now growing, more and less simple, or complicated.

Mosses are *cryptogamous*; wheat is *monocotyledous*: and oaks and elms are *dicotyledous*. Then every fact in fossil remains proves conclusively, that each kind was prior to the other; and that three series of creations, or gradual transformation of varieties took place, by different soils and elements, as the tools of creative power.

The roofs of many coal-seams are often entire trunks of fossilized trees, and muscle and oyster-shells are also abundant in the roofs.

Ferns are also abundant, and of those arborescent species now found only within the tropics, where 1200, out of 1500 species flourish. They once were common in the new red sandstone period all over middle Europe, and 120 species are found in the coal formations.

Lepidodendrons, which now rise no higher than 3 feet, were in the lowest coal series great trees, whose fragments are 45 feet, such as are only approximated in the tropics.

Calamites, sigillaria, and stigmaria, other trees and plants in the coal formations, are now extinct, though their trunks in them are from 1 to 3 feet diameter, and so sturdy, that the second are often found erect in sandstone cliffs adjoining coal-beds, sometimes with roots, and sometimes the roots seem torn off, or being softer, perished from want of infiltration. When lying they are pressed nearly flat, and often 15, 20, and 40 feet long. Brogniart makes 42 species of igillaria, and he refers it to the genus cacti.

As submersions destroyed forests, so we have their beds, but 94,500 years has not sufficed to render all of them perfect coal; and we have, instead brown coal and surturbrand. At Œningen 36 species of 25 genera have been found in the strata similar to those in brown coal, but different from living plants. The same vicinity has produced fresh water shells, fossil fishes, and a salamander 3 feet long.

In this period are also found many of the 1000 species of living palms, their fruit and leaves, in all parts of middle Europe. In both Indies they are often found on the open ground, after being silicified in strata, carried away from them by submersions. Dates, and all tropical fruits, are found in Sheppy, and cocoa and aurica-nuts are found near Bruxelles and Cologne.

A great forest appears to have been submerged in all parts of the surface of England, and De la Beche says, that in Cornwall it contains remains of man, and fragments of stream-tin round the roots.

Miners are familiar with a prodigious variety of vegetables, none of them like the plants of the present country. Remains of palms and tropical plants are found in England, and all over Europe.

Forests of standing trees have been discovered in Yorkshire and in Ireland, in stone.

Two or three hundred species of cryptogamous plants are found in carbonaceous strata, but dicotyledonous are rare.

The arborescent fossil forms found in our coal-beds have also been found at Melville Island. The old strata indicate greater heat in the temperate and polar circles than exist at present.

A fossil forest has been discovered under the banks of the Tiber, petrified with calcsinter, mixed with volcanic dust.

Wood is found in Languedoc, part jet, part wood: and trees have been found converted into jet, but so entire as to distinguish their species, as walnut and beech.

In Zealand, twenty-four feet below the level of the sea-dyke, there have been found turf, old alder, and other trees.

Bogs in Ireland are remains of fallen forests, covered with peat and loose soil, often forming hills. The rain in Ireland has added to this feature of all countries.

Coal is ancient peat beds, or fallen forests, or both. The sandstone, slate, and shale beds of the coal formations abound in vegetable fossils, and below the coal a large tree has been found 36 feet long and 3 diameter. Shale beds are rich in vegetable fossils, as gramina, junci, and cryptogami of vast size and richly marked, but all land plants, as ferns, club-moss, &c. &c. In English coal-mines 2 or 300 species have been detected of ferns, club moss, calamites, reeds, lepidodendrons, cacteæ, and palms, at least 50,000 years old.

In the magnesian limestone, over the coal, only 8 species of fuci, or marine plants, have been found.

300 species of plants have been classed in the coal-beds, 200 cryptogamia, and 100

dycotyledons. The trees remain in their roots, and the broken branches are found in the sandstone, often in casts, as wrecks of overwhelming floods. The fish, zoophytes, conchifera, and mollusca, amount to some hundred unknown species, but no remains of quadrupeds or birds, too complicated for that stage of organization

Coal-fields are covered with shales, or new red sandstone, or they would have been fossilized by infiltration, and where bituminous coals are wanting, the submerged forests had not this covering. The forests that produced thick beds of coal must have resembled the compact forests of Brazil, North America, or Africa, where their accumulating remains form elevated tracts, so that future strata overlaying them will convert them into future coal-beds. The shale over and between the coal-beds is rich in fossils, and also the slate over and between the limestone beds, as at Barrow.

Trunks of trees, in strata, are common occurrences, and they are chiefly of the palm kinds. One of 60 feet was lately found in a stone quarry in Lothian. It stretched through 10 or 12 strata of white sandstone, but its back had become pure coal. Others are found, of 2 feet diameter, standing on the floor of the coal-beds, and rising through the upper strata. The roots are in the adjoining shale. At Gosforth one was found 70 feet in length, oblique to the strata.

Hutton has discovered that if coals are cut into thin slices, their vegetable structure can be traced with the microscope, and numerous cells discovered that are filled with a yellow bituminous liquid which creates the flame of common fires, and whose gaseous form is the gas used in lighting. Difference in coal arise from difference of vegetation, and the coal strata have produced the fossil flora of Steinburg, of Witham, and of Lindley and Hutton.

Coniferæ of the genus auricaria, abounded in our carboniferous and other strata, and some have been found near Edinburgh 47 feet long, and 33 feet diameter. Witham found 8 species in lias, and 4 are in the oolite of Stonesfield. A forest of them has been found on Portland stone, the trees in fragments, and the roots in the ground.

Half the flora of the secondary strata are coniferæ and cycadeæ, and of the latter 4 or 5 genera, and 29 species of the palm family, all now tropical.

After the submersion of the forests, the new red stone above contains but 5 species of algæ, 3 calamites, 5 ferns, 5 comferæ, 2 siliaceæ, and some endogenous plants, products of the seeds of the coal formation.

The fossil plants found in Devonshire belong to transition level and schist, and those in Pembrokeshire to coal above limestone. They were similar.

The plants in the coal formations of Baffin's Bay are similar to those which now flourish between the tropics.

Fossil horse-tails (*Equisita*) are 10 or 15 feet, and fossil club-mosses rise 60 or 70 feet.

The shale over the coal-beds in Bohemia is splendid in perfect vegetable remains; equal, says Buckland, to the most gorgeous tapestry.

Standing trees with roots are found in Balgray quarry, near Glasgow. They are 30 inches in diameter, and were cut off at about 2 feet by upper strata.

Screw-pines, now tropical, were indigenous in Britain, in the age of the oolite formation, next but two to the chalk, and their fruit is a common fossil of that formation.

The lias and oolitic formations contain fewer ferns, calamites and palms, and above the chalk the plants resemble the modern flora.

In Tilgate forest *Vegetable Remains* are numerous, and the most remarkable is the *Clatharia, Lyellii*, of which there are specimens of the internal and external parts of the stem, in a beautiful state of preservation. The other large vegetable is the *Endogenites erosa*, of which there are enormous stems.

A workman at New Haven, U. S., lately broke a mass of very firm conglomerate rock, and found lodged in a cavity, a piece of perfect wood, the small limb of a tree, apparently of the pine family, with the bark entire, and the wood not mineralized.

Surturbrand, or black mineralized wood, is found in Iceland, either oak or pine. And near it a stratum of schistus in plates, like writing-paper, with impressions of leaves like poplar or willow.

Trees are often found in Lapland and Siberia, converted into iron ore and carbonate of copper. Lignites are petrified trees, in a state between peat and coals.

In the Cabinet of Mineralogy, in Languedoc, are several pieces of wood, whose external part is in the state of jet, while the internal part still remains in the ligneous state; so that the transition from the vegetable to the mineral state may be distinctly observed. At Montpellier have been dug up several cart-loads of trees converted into jet, with their original forms so perfectly preserved, that the species of trees thus bituminized can often be determined. Specimens of jet can be distinctly recognised, as the walnut-tree and the beech. A wooden pail and a wooden shovel, M. Chaptal, whose authority is undoubted, affirms to have been found converted into pure jet.

Fossil Zoophytes, &c.

Zoophytes are the oldest animal remains, a step between the vegetable and animal.

It appears that no germs of animation are found in strata, till we rise to *the limestone formations*. We first find shell-fish, and as the lime increases, the varieties and complication of vertebrated animals increase. Shells and bones are carbonate and phosphate of lime, and of course they are its results.

Crocodiles have been found *beneath* the chalk, alligators and tortoises *in* the chalk. Fossil bones exist *beneath* the chalk. Hence it is inferred that dry land and fresh-water existed before the chalk. Mammiferous la-

mentins and seals are first found in the coarse shell limestone which covers the chalk; and above this, in sand and rounded pebbles, the remains of mammiferous land-animals, but of different species from the present. Forty-nine are new; seven belong to new genera, and other twenty-two belong to new species of known genera. The bones of species now known are never found but in light, upper, alluvial deposits. Several successions of convulsions and changes are evident; but as the last and every overthrow was of rocks in mass, which themselves contain shells, vegetables, bones, &c. &c. the previous existence of such is undeniable. "The imbedding in strata of such multitudes of testaceous fish, who could not be drowned, proves that desiccation, as well as water, has been an operative cause.—*Cuvier*.

Ammonites form some hundred species, from a diameter of four or five feet to aggregated millions of a few pounds.

Coral formations occur chiefly between 30° of lat. in the Pacific; also in the Indian Ocean, the Red Sea, &c. Their increase is very slow, not above six inches in a century. In 32 surveyed, they varied from 30 miles to 1 in diameter, and 29 still had lagoons. The thickness of the walls is from half to a quarter of a mile. The lagoons gradually diminish in breadth and depth. Some have latterly considered them as extinct volcanoes, to which corals have attached themselves; and Mr. Lyall favours this opinion. Disappointment Islands and Duff's groupe are connected by 600 miles of coral reefs, over which the natives can travel.

Coral reefs are believed to be of very prolonged formation. They are evidence of an antiquity of the world far exceeding all received estimate. Aqueous plants and floats of land ores, seeds spread by birds, &c. soon cover them when above water. Beneath the water, (Flinders says,) he saw wheatsheaves, mushrooms, stags' horns, cabbage-leaves of all vivid colours, and resembling a garden. Nor are corals the only producers of these reefs, for among other shelly inhabitants were enormous cockles, from 50 to 200 lbs. weight. The rocks formed of dead corals and remains, united with gluten, are compact, dense, and in perfect cohesion. On the east of New South Wales is one reef 500 miles long, and upwards of 200 fathoms perpendicular; mountains of limestone.

Within half a mile of many coral reefs, there are no soundings to the depth of several hundred fathoms.

Polypes, so infinitely numerous, are mere gelatinous bodies, or stomachs in shells of carbonate of lime, which subsist as such after the life of the polype, and form mountain masses at the bottom of the ocean. Their genera are called madrepora, astrea, careophyllia, meandrina, and mellepora, and they are found in vast quantities as fossils under the name of coral-rag in most parts of England.

Orthoceratites, lituites, baculites, hamites, scaphites, turrilites, nummulites and belemnites, were other forms of ammonites, with shelly structures and apparatus equally surprising, and extending as fossils through the transition and secondary strata, but extinct, perhaps, 100 thousand years since. The nummulites resembling coins are so numerous as to form extensive calcareous mountains, and yet so ancient that they abound in the stone of the pyramids and sphinx, and even then as embedded fossils.

Tribolites are also a numerous class, and of curious formation with large eyes containing 400 lenses nearly spherical.

Buckland states, that though animals and vegetables of the simplest forms prevailed chiefly in early formations, yet he quotes the nautili, the ammonites, the trelobites, &c. &c. to prove the contrary.

The polypus family abounds in the transition and subsequent formations in every form in which they now exist, and many others highly curious. Encrenites and pentacrites are found in extensive masses in Derbyshire and other limestone countries. The crinoideans had nine genera, every one composed of 26 thousand calcareous joints, or bones, capable of reproduction, but they were extinguished before the lias. The pentacrinite resembled star-fishes with 100,000 bones, and their tentacula spread like a flower, or collapsed like a bud, while their side branches made up another 50,000 bones, the star-fish having but 3000.

The great coral reef of New Holland is 350 miles, unbroken, and then in parts 1000 miles, and from 20 to 50 in depth.

Fossil-Shells and Fishes.

M. De Basterot states, that, of the shells which occur fossil, there are—

	Genera.	Species.	Resembling the existing.
Chambered	29	297	6
Univalves.........	81	1141	151
Multivalves and Bivalves	111	1091	107
	221	2529	264

Deshayes has a collection of 5000 shells of living species, of which 3000 are in tertiary strata. Out of 782, 426 are living and fossil, and 356 fossil only. Testacea are not destroyed by the periodical inundations of the ocean, like other beings. Of 1122 fossil shells in the Paris Basin, only 38 are of recent species; and, out of 226 Sicilian, 216 are recent.

Testacea distinguish land, marine, and fresh-water formations, different species being common to each, and of all ages.

1234 species of fossil shells have been described in France and England, of which only 42 belong to adjacent seas and near London; they are mostly extinct species. Other thousands have been found in other countries, mostly extinct.

The shells of microscopic animals contribute to the bulk of many rocks

Fossil sea-turtle have shells 8 feet long.

Soldani extracted from 1·5 oz. of stone, in Tuscany, 10,454 microscopic chambered shells. 4 or 500 weighed but a grain, and

they passed in numbers through holes made by a fine needle. The genus lypris is also incredibly numerous.

Fossil shells are found in mountains every where; and they abound in the stone of which the Egyptian, Grecian, and Roman structures are formed.

Shells and organic remains are found in Chili, from 9 to 14,000 feet above the sea. Mountains in Sicily, 3000 feet high, abound in existing testacea and zoophytes.

There are beds of sea-shells 2000 feet high, on Etna, and strata of grey clay, filled with shells, much higher. The base is lava and marine substances in alternate layers; and beneath a stratum of lava is a stratum of rounded pebbles, while above it are calcareous eminences formed by the sea. A Sicilian canon, who examined some of the beds of lava, separated by rich soils, has calculated that at least 14,000 years have passed during their formation.

Sea-shells are found 4 or 500 feet above the present level of the sea, at Van Diemen's Land.

Recent shells are found in Chili, 1300 feet above the sea-level, and a forest is growing over a bed of recent oysters, 350 feet above the sea-level. Immense quantities of the bones of the mastadon are found near Santa Fé in Chili, and others 600 miles distant. Also remains of the megatherium. Granite peaks have 14,000 feet of elevation, and Mr. Darwin thinks the granite must have been fluid since the tertiary rocks.

More recent information leads to the conclusion that many of the phenomena of shells, &c. in elevated positions in Chili, &c. have arisen from sea-waves in earthquakes.

The fossil oyster-beds rest upon the chalk. The strata above contain fresh-water and marine shells.

Univalve and bivalve shells are the earliest reliques of the transition limestone rocks, with some articulated and radiated animals, curious in structure like all organization, with eyes for light, and other organs of senses, though of inconceivable antiquity. The conchifers, or bivalves, like oysters, had no eyes or head; but the inhabitants of univalves had both, and were of a higher order, partly herbivorous and partly carnivorous, the latter being more modern.

The *Shells* in Tilgate forest consist of univalves and bivalves, allied to recent fresh-water genera. In some instances they constitute entire beds of limestone, of which the Sussex marble is a familiar example.

The nautilus varies in strata, one species in transition rocks, one in shelly lime-stone, two in the oolite, and two in the chalk; five or six appear also in the tertiary, till we arrive at our nautilus pompilius and the paper nautilus.

The most abundant species of animal existences, in the transition and secondary strata, were chambered shells from the ammonite three or four feet in diameter, beautifully decorated, to those of which many hundred weigh but a grain. They were all constructed on true hydraulic principles full of air cells, and these regulated for ascent and descent by a syphuncle extending from the animal in the outermost to the smallest in the centre. They were to the full as wonderful as the hives and cells of bees, or the webs of spiders, or as any construction of man, and yet the entire family became extinct in the age of chalk. 17 species are found in transition strata, 7 in carboniferous, 15 in new red sandstone, 137 in the oolitic system, 47 in the green sand and lower chalk, but in the tertiary systems none. They prevailed every where, and in all climates, and the small ones often form whole rocks. Their purposes, economy, habits, &c. &c. are a profound mystery.

Of the 8000 species of living fishes, different proportions are found in different strata. Only placoids and ganoids are found before the age of magnesian limestone, when the placoids became extinct; and the ganoids prevail till after the oolite series, when they suddenly became extinct with the chalk formations. The ctenoids and cycloids commenced in and after the chalk, and form three-fourths of the present fishes.

Fossil fishes have been found in new red-sandstone, at Dungannon, reposing on mountain limestone. The quarry consists of red and green marl, passing into dark-red silicious sandstone, and at 30 feet deep are fishes in abundance, while the surface of some of the beds have ripple marks.

The fishes embedded in chalk or above it, are not generally the same as those at Monte Balca. Mantell's museum contains the former, but the last are earlier and of 127 extinct species, and 38 extinct genera. There are also 39 new genera, and still existing.

150 species of the shark family only exist as fossils. They begin in the transition series, and became extinct in the commencement of the age of chalk. But the squaloid family then superceded and continues.

Agassiz describes 300 new species of fossil fish found in England, making the whole 400. The simplest and earliest are in the Silurian System. 20 species in old red sandstone. 54 in coals. 16 in magnesian limestone. 150 in oolite. 50 in chalk. 50 in London clay. 6 in crag.

The Geological Society have a slab 2 feet square, in which is imbedded 250 fishes.

Below the lias, Agassiz finds no trace of two of the orders of fishes; but the other orders then appear with large sauroid and carnivorous fishes.

Types of the cuttle-fish and species of cephalapods, with feet round their heads, are common fossils, and their ink-bags and horney pens are found perfect in the lias of lyme regis.

The fishes of the carboniferous period were different from those of the lias, these from the oolite, and these from the chalk. Agassez thinks that those of each epoch were suddenly destroyed.

Of 17 genera of sauroid or lizard-like fishes, only two now remain in fresh water. They had teeth over their palate. They are found between the transition and chalk for-

mations in coal lias and oolite, and disappeared with the chalk. Fishes previous to the chalk had mostly such scales as served as a sort of armour, but not a single species exists of those found in the oolitic series below the chalk! The formation of the magnesian limestone and the chalk, seems to have been fatal to them.

Fossil fishes are found in masses at Saarbruck, Mansfield, Solenhofen, Glaris, Oeningen, Aix, and Monte Bolca, of extinct species, species of other seas, &c. Agassiz is the laborious classifier of them, according to the four orders of placoids, gunoids, ctenoids, and cycloids, depending on different scales.

Fossil Quadrupeds.

Elephants, and animals much larger than elephants, called Mammoths, have been found in Europe, America, and Siberia. One found near Abingdon, now at Oxford, is sixteen feet high, and its bones were mixed with those of other large animals; another was found in Siberia in the ice, quite perfect in its flesh, skin, hair, and eyes, with a long mane and tail of stiff black bristles; others have been found in Hudson's Bay.

Fossil remains found in hills at the foot of the Himalayahs correspond with those in Europe, and consist of genera of the mastodon, elephant, hippopotamus, rhinoceros, hog, horse, ox, crocodile, fishes, and shells. A monkey of a large species is also found.

The fossil elephant differs in the teeth and skull from the modern Asiatic and African.

Lizards, twenty-four feet long, equal to the dragons of antiquity, are found at Maestricht and Bavaria.

The *mastodon* of North America was the largest species of land animal hitherto traced. Its bones are not uncommon in New York and Kentucky, and a system of them, arranged in Peales' celebrated Museum, is 18 feet long, and 11 feet 5 inches high, with tusks 10 feet 7 inches.

The *mammoth*, a species of elephant, nearly as large as the mastadon, has been found 14 feet long, and 9½ feet high, with tusks 9 feet. It is chiefly found in Siberia, and often in ice; but its remains are wide spread in various countries, and have appeared even in the Andes.

A mammoth's bones have been found at North Cliff, Yorkshire, surrounded by thirteen species of fresh-water shell, still found in the district.

The gigantic mastadon is found in North America and Siberia. The gigantic tapir, twelve feet high and eighteen feet long, has been found in different parts of Europe. Whales are found in Essex, in London clay.

The *Dinotherium* is described by Buckland as the largest of terrestrial animals. It had 2 enormous tusks, and is found in Hesse Darmstadt.

The *Migatherium* was a gigantic sloth in the pampas of Paraguay, with armour like the armadillo. Its length was 12 feet, and heighth 8 feet. Its haunches were above 5 feet, and its feet a yard long. Its tail was two feet diameter next the body, and longer than that of any animal.

The *Ichthyosaurus*, or *fish-lizard*, was 30 feet long, with the snout of a porpoise, the teeth of a crocodile, the head of a lizard, and the paddles of a whale. It belonged to the secondary strata. Bones of the largest are to be seen in the Mantillium Museum at Brighton. There is also a fine specimen in the British Museum. They resembled crocodiles, and their jaws were 6 feet long.

The *Plesiosaurus* is another reptile of gigantic size, with a neck 4 times the length of the head, containing 33 vertebræ, more than the swan, with above 100 crocodiles' teeth. It is perfect in the Mantillian Museum.

The *Mososaurus* of Maestrecht was 25 feet long, or 5 times the modern monetor, with 133 vertebræ.

The *Megalosaurus* was a lizard from 40 to 50 feet long, in figure between the monetor and crocodile.

The *Iguanodon* discovered by Mantell is the largest of known reptiles, but herbivorous, and full 70 feet long, or 12 times the size of the iguana. The tail is 52½ feet, and the body a diameter of 4 feet 9 inches. It had a horn of bone.

The molar tooth of a mammoth weighs 8 lbs.; and the knob of the bone of the leg is a foot in diameter. It was a carnivorous animal, and the Indians have traditions of their terrible mischiefs.

Mr. Crawfurd has presented to the Museum of the Geological Society the fossil remains of two new species of mastadon, and of other vertebrated animals found on the left bank of the Irawadi, in Ava.

Gigantic bones, lately exhibited at New Orleans, consisted of one of the bones of the cranium, 15 or 20 vertebræ, two entire ribs, and part of a third, one thigh-bone, two bones of the leg, &c. The cranial bone was upwards of 20 feet in its greatest length, about 4 in extreme width, and it weighed 1200 lbs. The ribs measured 9 feet along the curve, and about 3 inches in thickness. The animal, when alive, must have measured 25 feet round, and about 130 feet in length.

Fossil bones of the great mastadon, and other animals, have been discovered in the Birman Empire.

The Palæotherium was between the horse and the hog. The Anoplotherium was between the rhinoceros and the tapir. The Megalonix and the Megatherium were sloths between the ox and rhinoceros. The Ichthyosaurus was between a fish and a lizard. The Plesiosaurus was nearer the lizard.

In Jackson county, Ohio, a tusk has been found 10¾ feet long, and 2 feet round, weighing 180 lbs. A tooth of the same animal weighed 80½ lbs.

At Bigbone Lick, near Cincinnati, are found masses of bones of the mammoth, and also hoofs of horses, in a fossil state. Bullock has found the head of a mammoth with signs of a trunk.

In some caves in France there is an in-

contestible mixture of human bones, with bones of mammifera belonging to extinct species. The remains of animals, mixed with those of the human species, belong to the hyena, the badger, the bear, the stag, the aurochs, the ox, the horse, the wild boar, and the rhinoceros; and some of the bones bear marks of the teeth of hyenas.

Tournal concludes that man was contemporary with the fossil animals found in caves; that the bones depend on localities; that the stones in the mud are those of the vicinity; that the periods of formation were very long. He enumerates nearly 40 species of animals, and all the larger ones, besides birds, lizards, and snakes.

The stone which encloses the Guadaloupe skeletons is harder than marble.

Fossil remains have been found in Mauritius and Bourbon; and, latterly, extensive discoveries of like kind have been made in New Holland, where bones of large animals are found, of unknown genera, which do not now belong to the country. There appear to be caves or accumulations of them, but they differ from European genera.

Pallas tells us, that the islands of the Icy Sea are full of elephants' and rhinoceros' bones, and that the islands opposite the Lena are almost composed of them and fossil-wood—a proof, in spite of Cuvier, that the Tropics once extended to 45° or upwards, forming but two zones on each side the Equator.

Fossil bones, in general resembling those which have been found in the caves of Germany and England, and latterly in those of France, have been discovered in a Cave of Miremont, (Dordogne,) with remains of pottery, &c. In a cavern of Lunel Viel, there have been found the bones of twenty-one recognized species, imbedded in a fresh-water alluvium, including two varieties of the hyena, the lion, bear, rhinoceros, horse, deer, ox, shark, and sea-tortoise.

In a spacious cave in the Cumberland mountains, Tenessee, there was lately found two petrified men and a dog. One standing with a spear balanced in his hand, and the other sitting on a rock. The dog lying as in the act of springing. This instance, and those of the sudden deaths in Bolca, &c. seem to indicate that some gaseous phenomenon must have operated in the progress of nature, thus to extinguish life, and petrify at the same time. It is a district too of mammoth's bones, and the vicinity abounds in fossils of extinct species. It may seem to prove, that man was contemporaneous with those species so very remote in time, and other recent discoveries in caves in France tend to the same proof.

The Kentucky cavern has been penetrated above fifteen miles, a small portion of its real size. A female mummy found in it has been a vulgar show through the United States.

Trimmer, in Cefn Cape, gives clear proofs that a marine submersion followed the existence of the rhinoceros and hyena, in the tertiary series.

The bones found in caverns are proofs that Britain joined the Continent, when hyenas, bears, &c. ranged its forests. Also that the tropics were wider.

Eight species of birds are found in gypsum, near Paris. Crocodiles are found in blue clay in Dorsetshire, and on the opposite French coast.

Foot-steps of birds have been found on new red sand-stone, in Connecticut, which, from the size of the foot, and length of the step, must have been twice the size of the ostrich. Others of smaller birds have also been found; and at Dumfries, and in Saxony, other footsteps of small, and also very large animals, have been found and depicted.

Blasting is used for the hardest limestones, green-stone, basalt, sienite, gneiss, and granite; and from 8 lbs. to 21 lbs. of powder is employed for every cubic foot above it, according to the density.

For roads, taking Mountsorrel sienite at 100, the hardest material is copper slag, 234; Scotch granite and Quittle green-stone, 110; blue pebble, 105; Leeds grit-stone, 15; flint, yellow, 33, and black only 11; paving-stone, 20.

Near Merthyr Tydvil, impressions of horses' hoofs are discovered on an ancient sandstone.

Silicified coniferæ trees are found in the new red sandstone, at Allersley, near Coventry. Others of palms, &c. have been found in the same formations in Saxony. Yorkshire, &c. abound in them.

An ancient beach, elevated in the cliffs, is traced in Barnstaple Bay for many miles, abounding in shells of the adjacent waters. Another beach, under the chalk, is traced at Brighton, strongly cemented. All round Devon and Cornwall, the same beach is observed, from 40 to 70 feet above the present sea-level. In Cumberland, &c. it is 300 feet above the level.

450 species of shells nave been collected by Wood, from that important formation the Norfolk and Suffolk crag.

At the Southern declivity of the Himalayas, in conglomerate of muriate and clay, 1000 feet above the sea-level, there have been found bones of extinct species of many large and small mammalia and fish, with fresh-water shells.

Captain Cautley discovered, near Behat, a town buried 17 feet below the surface, while he was directing the formation of the Doab canal.

A fossil gigantic lama has been found in Patagonia, and other remains of very large extinct animals in Chili.

Goppert has imitated the processes of petrifaction and oxydation.

There are caverns with bones of elephants, rhinoceroses, horses, oxen, sheep, hyenas, dogs, wolves, foxes, bears, &c. at Yealm Bridge and Ketley, near Plymouth.

All the land near the Clyde, lies over beds of shells, and bones of elephants, stags, &c. At the same time, the ancient vitrified forts, the Roman walls, &c. refer to the present level.

The horizontal fracture of Havannah coal gives a series of eccentric rings, like casts of large shells.

Lyall thinks that the non-existence of fossil remains in crystallized rocks, is no evidence that the materials crystallized did not contain them. He thinks, also, that granite has been in liquid petrifaction, but not all at the same time.

The skull of the tivatherum, lately discovered in India, is 20·6 inches long, and 22 broad. The animal is to the elephant as 12·38 to 15·06.

Mineralogical maps have been contrived by Humboldt: in which limestone is represented by straight lines, salt by straight declining lines, porphyry by waved lines, granite by irregular points, &c. &c.

Silica is the predominant substance, and silicates of alumine and the alkalies are the principal terrestrial products.

One fault in Coalbrook Dale produces a difference of level of 6 or 700 feet, and another 300 feet.

The formations and fossils of Africa correspond with those of England.

At Maria Island, near Van Dieman's land, there is a cliff from 2 to 500 feet of dark limestone formed of oysters, muscles, and other shells.

An upper coal-seam, at Dudley, is 10 yards. The lower beds are iron stone.

The coal measures in the central counties are, in general, worked only to the new red sandstone, but there are valuable beds beneath it.

The salt-mine at Durrenburg, in the Salzbourg, displays galleries and excavations 7000 feet in length, within a vast mountain.

Nothing can be more gratuitous and romantic, than the favourite theory about subterranean upliftings. In its support, most Geologists put out one eye. Consolidation or sinking is at least more reasonable; but, in certain cases, as at Greenland and in the Baltic, it is not easy to distinguish between the rising of the sea and the lowering of the land. Both sinking and up-heaving may, however, occur from local causes, but not as the rule, only as the exception; not as the course of nature, but as phenomena. That the North-Western shores of the Baltic are sinking, seems to be confirmed, while the North-Eastern seem to be forced up by the sinking of the other.

Mexico has coal-mines, iron-mines, and tin-mines.

The foreign substances, inter-stratified with coal, are pyrites, shale, galina, fire-clay, calcareous spar, quartz, sand, and iron-stone.

Trees are also found upright and inclined.

The rivers have scooped out and carried away large breadths of the Newcastle coal-field, and the ascents are a section in the outcrops of all the seams as they live above the mill-stone grit. In consequence, many adits have been horizontal as well as drainage. On the shores the seams dip under the magnesian lime-stone.

The High Main Seam is the chief, 9 miles square, and the others are the Two-yard, the Belcham, the Hight Quarter, and the Hutton Seam.

Coal-mines seldom have above 4 or 5 workable seams, but these vary from 1 inch to 72 inches. At Monkwearmouth there are 31 seams in 1581 feet, with 47 feet of coal, and only one worked. At Blackworth, in a depth of 1236 feet and 283 various strata, there are 45 seams, with 60 feet of coal, of which only 2 or 3 can be worked. Most of the seams are not continued, but divide into others.

The ninety-fathom dyke at Cullercoats extends to great distances. At Whitby, it depresses the seams 510 feet, and, further West, the Northern side is 1200 feet lower than the Southern. Other faults run from it. Buddle thinks it was formed when the parts were soft and yielding.

The flints in chalk, near Norwich, are crossed by perpendicular planes or rows of larger flints, some yards in height. Sedgwick thinks they were petrified sponges, which grew out of one another.

The ground-swell is the reaction of the deep waters by the oceanic librations of the mass. Various circumstances of place and time concur to render it sensible, though in general it is diffused in the superficial waters.

On the Sussex coast, the mean velocity of the tide is but two miles an hour, so that the tidal superfices move backward and forward but 12 or 14 miles. In the 300 miles of our south coast, there are full 20 forward and backward tides at every high and low water.

The oscillation forward is 13½ days and 13½ backward in performance—during which the Earth and waters cross the Fulcrum-orbit twice. It is to all purposes a perfect vibration, as much so as a pendulum, and in efficiency cannot be otherwise considered. It is the sole cause of the Tides, and all their phenomena, and is itself caused by the reciprocal orbit and action of the Moon.

If any one draw a circle, divide it into 365 parts, and draw twice 13·37 curves, or a continuous wavy line outside and inside, so that their rise without, and their withdrawal within, may be deemed 5000 miles; then those wavy lines will represent the oscillations of the Earth in its relation with the Moon, and the same oscillations will also be those of the waters on the Earth, for the period of a Moon. Where the lines cross is the point of the quadratures, and where most distant the new and full.

HYDROLOGY.

We live upon a globe whose surface is water and land. Pride leads us to give precedency to the latter, but figures tell us that the former is as 3 to 1, or 150 to 47, and nature shows us that soil and minerals are mere vehicles to the activity and agency of water. Nor is it only in a mechanical sense that water effects so many wonders; since, by weight, it is formed of 8 parts of oxygen,

and 1 of hydrogen; and by volume of 1 of oxygen and 2 of hydrogen: and therefore it possesses within itself high powers of chemical union and decomposition.

Some of the epigrammatic philosophers of Greece referred all things to *water*, and not without reason. It is the agent of all terrestrial activity, the universal percolator and solvent, the transferrer of atoms from body to body, of soils from place to place, and of land itself into the silent bosom of its own depths. Its tides and currents, its evaporations, its circuit as clouds, rain, and mists, and its subservience to heat and atmospheric pressure, render it the Universal Fertilizer. Then its decompositions yield the elements of hydrogen and oxygen, and so vary its mechanical products, as even now to justify the conclusions of Thales and others, who had not witnessed, like us, the triumphs of the steam-engine.

We treat it as a subordinate of Geology, but in truth it is the absolute master, former, and secondary agent of the power of motion in every thing terrestrial. It is that local display of the motions of the earth, as a planet, which elaborates every thing; and the waters contain far more organic beings than the land.

The surface of the sea is estimated at 150 millions of square miles, taking the whole surface of the globe at 197 millions; and its greatest depth is supposed to be equal to that of the highest mountains, or four miles; but La Place thinks that the tides demand an average depth of three miles, therefore the sea contains 450 millions of cubic miles of the 258,000 millions in the whole globe.

The Pacific Ocean covers 78 millions of square miles, the Atlantic 25 millions, the Indian Ocean 14 millions. The Southern Ocean to 30 degrees is 25 millions. The Northern Ocean five millions. The Mediterranean 1 million. The Black Sea 170,000. The Baltic 175,000. The North Sea 160,000.

The sea swarms with life like the land, in forms kindred to those on land, for the principles of the economy of all locomotive beings have the same general types.

Water and mercury are the most perfect liquids; others are more or less viscous. The particles of liquids move and press equally in all directions; those of solids only downwards. They press on any surface, as the base by the distance to the upper surface of the fluid The pressure is distinct from the weight of the mass. It is as the heighth whatever the base. A cone and cylinder of liquid of equal heighth have the same pressure.

As every atom of a fluid is carried by the two motions towards the centre, so, when embanked, the whole attains a perfect level. It is believed that the freedom to move arises from the motions of the atoms among one another. All water, therefore, seeks the lowest level.

The state of fluidity is preserved by the pressure of the atmosphere, the motion of the atoms being less than that of the atoms of air. Hence water expands into gas, either when the atmospheric pressure is removed, or when the atoms of water acquire more motion by the access of heat.

The earth would vibrate, owing to irregular forms of its solid granitic nucleus, but for the mobile waters, which preserve the balance of its sides and parts, and accommodate themselves to any unequal impulses of rotation. But as the Americas run from north to south, it may be suspected that they rotate a small fractional part above the general distance from the centre, and are colder.

Between the Tropics the temperature of the sea is from 77° to 84°. It diminishes to 45.5° at 1000 fathoms depth. But, in the Arctic Sea, the temperature rises from 8° to 10° at 700 fathoms, and 6° at 200 fathoms.

The sea is bluish green, and the Arctic sea is ultra-marine, and transparent blue to olive-green or opaque, in stripes caused by animalculæ and medusæ in countless myriads. In the Gulf of Guinea it is white, and round the Maldives black. In other places it is red and purple. The solar rays penetrate 2 or 300 feet, and objects may be seen in Arctic and West Indian seas at 150 feet.

The sea is still at a certain depth. Divers report at 30 feet.

Sea-water appears to contain from 3·4 to 4 per cent. of salt. Its specific gravity is 1·028. The salt-lake of Ourmia has specific gravity 1·16507, and the Dead Sea 1·211.—*Marcet.*

Salt, so universally diffused, is an effect of oceanic submersions, and of desiccated lakes re-supplied by tides in countless ages.

The component parts, with very slight variations, are water, muriatic acid, sulphuric acid, mineral alkali, lime, and magnesia.

British sea-water contains, in 1000 parts, 22 of salt, 3·3 of sulphate of soda, 4·2 muriate of magnesia, and 0·8 muriate of lime.

Sea-water is salt and bitter at the surface, but merely salt at great depths.

Sea-water varies in sp. gr. in different seas, about 1-500th. The Mediterranean is 1·0293, and the Atlantic 1·0283. The Black Sea is but 1·01418 owing to the great rivers.

The luminosity of the ocean arises entirely from small insects, whose figures have recently been exactly determined by observations with the microscope

Fresh water begins to freeze at 32°, called the freezing point, but salt water not till 28½°. The atoms lose the motion called heat, and become fixed in crystals.

Young estimates the Atlantic at 3 miles, and the Pacific at 4 deep. The Mediterranean varies from 1¼ mile to a quarter.

Parry, in lat. 57 N. long. 24 W., sounded to the depth of 1020 fathoms without bottom. Copper globes are compressed at 800 fathoms. Below 50 or 100 fathoms the water is perfectly quiescent. Scoresby sounded, in 75° and 76° N., 1058 and 1200 fathoms, but found no bottom.

6000 feet have been sounded in the Caribbean Sea. 4680 feet of line did not reach the bottom of the Northern Ocean. The greatest depth in the Straits of Dover is 29 fathoms, and off Bergen 190 fathoms.

A sea is vulgarly said to have no bottom,

when the difference between the sp. gr. of the line and water exceeds the plumb, or when an under-current carries the line aside.

The sea varies in depth as the land adjoining is flat or mountainous.

Lakes have great depth: thus, the Caspian, in the South, has been sounded without bottom 2400 feet. Geneva is 1000 feet, and Loch Ness 800 feet. They do not freeze from this cause.

The Pacific is so called from its tranquillity. Its winds and tides are not deflected by land and mountains, and the smallest vessels pass in security. Its vast expanse can only be conceived by consulting a globe. It is the Sea of Corals.

The collection of oceans mingling round the south pole are of themselves an extraordinary phenomenon. They cover a third of the surface, but bounds have been set to their encroachments by pointed capes, whose foundations are connected with the granite base of the earth. The disposition to encroach on the land is evinced by the acute angles and mountainous character of all the promontories which present themselves to it; while, in the north, the passive character of the ocean is evinced by the obtuse forms both of Asia and America.

The Icy Ocean, north of Siberia, cannot be navigated, owing to Cape Severovostochnoi stretching among the ice; nor the sea to the north of America, owing to a similar peninsula, which stretches to 74°.

The Black Sea is believed formerly to have been united with the Caspian, and also to have extended its bounds to the north and west. Diodorus says, that cities formerly stood on the site of the Bosphorus. Tournefort adopts the same idea. Buffon thinks that the Black Sea, the Caspian, and Aral, were once one vast lake, and when a passage was forced through the Bosphorus, the sea was diminished in size, while it enlarged the Mediterranean; and hence the traditions of a deluge.

Olivier, a mineralogist, describes the islands in the Bosphorus as volcanic. Bergman, who travelled last in these districts, states as an undoubted fact that these inland seas were once one. Dr. Clarke adduces many striking facts in proof of the same theory, that a volcano opened a passage for the Black Sea into the Grecian Archipelago, and thereby drained the Steppes which lie between the Euxine, Caspian, and Aral.

Heeren maintains that the Aral and Caspian once formed one great sea, into which ran the Oxus and Jaxartes.

The waters of the Red Sea appear to be thirty-two feet higher than the Mediterranean, and the Gulf of Mexico is twenty-two or twenty-three feet higher than the Pacific.

The difference of level between the Pacific and Atlantic, at Panama and Chagres, is 3½ feet more in the Pacific.

The Zuyder Sea was formed, in 1225, by a storm, which arrested great floods of the Rhine, and these carried the soil into the ocean. In 1421, another such flood formed the Bies-Boos

There is a current from the American coast across the Pacific. One branch passes through Basses Straits round South Cape. Another north of New Holland. A South Pole current passes round Cape Comorin towards Africa, and doubles the Cape of Good Hope. At the Equator it passes West, and one part goes round Cape Horn, and the other passes North along the American Coast to Newfoundland, called the Gulf-stream; then meeting North Polar currents crosses to Norway and Ireland, and turns South. Its breadth is from 150 to 1000 miles, and its rate from 2 to 4 miles per hour. It resembles a great ocean river, which constantly returns into itself.

There is also a constant *westerly* current of open Tropical seas of 9 or 10 miles per day. Passing into the Gulf of Mexico, it *returns* by the Bahamas, and ascends to Newfoundland. Here another current reaches it from Baffin's Seas, and carries it by the Azores and Canaries into the western current again. It thus travels about 10,000 miles within 3 years, and its breadth varies from 140 miles to 400, and its daily velocity is about 3 miles. This Gulf-stream reaches also even to Norway, and carries tropical products to all Northern shores as the Orkneys, &c. A third branch enters the Mediterranean, and a fourth coasts Brazil and enters the Straits of Magellan.

A similar westerly current prevails in the Pacific, but produces no effects till forced to return in the Eastern Seas, and it partly escapes by the Cape of Good Hope, where it maintains a rough sea 130 miles wide with some degrees of increased warmth.

The Banks at Newfoundland are partly ascribed to the meeting of the Gulf-stream, and the northern currents, and probably these and other silent currents, in long time, change the forms of the surface of the globe.

The Atlantic contains other currents, often favourable to navigation. Thus there is one on the African coast, another from Gaboon to Ascension, which accelerates a ship one-fifth. Opposite Guinea there are two parallel currents, running in opposite directions, with a velocity of 68 to 100 miles a day.

An upper current runs into the Mediterranean, and a south current runs into the Baltic, on the Danish side.

Enclosed seas discharge the water from rivers by evaporation, and when no rivers they speedily dry up and leave beds of salt.

The currents of the Mediterranean are always constant and regular. Both the Euxine and Atlantic flow into it, besides the Nile, the Po, the Rhone, &c.

A corked bottle with a letter in it, cast into the sea in the mouth of the British Channel, was cast on shore at Barbadoes.

The following are the CHIEF RIVERS:

The AMAZONS, in South America, falls from the Andes through 2600 miles.

The MISSISSIPPI, from the Stony mountains, 2550 miles.

The HOANG, in China, from the Tartarian chain, 3260.

The YANGTSE, from the same, 3060.
The NILE, from the Jibel Kumri mountains, 2690.
LA PLATA, from the Andes, 2215.
The WOLGA, from the Valdais, 2100.
The EUPHRATES, from Ararat, 2020.
The DANUBE, from the Alps, 1790.
The INDUS, from the Himalayas, 1770.
The GANGES, from the same, 1650.
The ORONOCO, from the Andes, 1500.
The St. LAWRENCE, from the lakes, 1230.
The NIGER, or WHORRA, 1900.
The DON, the DNEIPER, and the SENEGAL, are each above 1000.
The RHINE and the GAMBIA 800.

The quantity of water discharged into the sea, by all the rivers in the world, is about 36 cubic miles in a day, hence it would take above 35,000 years to create a circuit of the whole sea through clouds and rivers.

Rivers hold in suspension 100th of their volume (more or less,) of mud, so that if 36 cubic miles of water flow daily into the sea, 0·36 cubic miles of soil are daily displaced.

The mud of large rivers extends continents at their debouches. It forms deltas of low lands, which in time unite with the main land, and form the plains.

The Amazons, the Oronoco, the Mississippi, the Nile, the Danube, Niger, Zaire, and Ganges, have deltas at their mouths, and the sea is muddy for a great distance.

The Mississippi adds 300 feet per annum to the main land from this cause; the Nile has advanced the land sixteen feet per annum since the time of Herodotus, and raises the surface four inches in a century.

The Po carries out the land 228 feet per annum, consequently Adrea, which, 2500 years ago, was on the sea, is 20 miles from it.

The Yellow River, in China, carries down two million cubic feet per hour of alluvium, so as to fill up the Yellow Sea.

The Nile begins to rise in June, and attains twenty-four to twenty-eight feet of elevation in the middle of August, and then floods the Valley of Egypt, twelve miles wide.

The Ganges rises from April till August thirty-two feet, and then creates a flood 100 miles wide.

The Euphrates rises between March and June twelve feet, and covers the Babylonian plains.

The Burampooter rises in the Himalayas, runs eastward towards China, and after a course of 1600 miles, when four or five miles wide, unites with the Ganges, and with it forms a delta to the sea.

The fall of the Ganges is four inches to the mile, and nine inches in the mile of land; of the Amazons four inches, and the land 6·75; and the Nile, 6 inches in 1000 miles.

The Delta of the Ganges is 200 miles long, and consists of woods called Sunderbands. The tides rise from thirteen to sixteen feet. Islands 25 miles in diameter are often formed and destroyed. It pours down from 80 to 400,000 cubic feet in a second.

The Mississippi flows through 20 degrees of latitude and 7 of longitude, and drains a valley 3000 miles long and nearly 1000 broad. It receives five or six rivers which are navigable 200 or 300 miles, besides the Missouri 3100, the Ohio 1000, White River 1200, the Arkansas 2500, the Red River 2500, and their branches, of great extent. In floods it spread over from 10 to 50 miles on the western side in the last 500 miles of its course from March to May. It has no tide, but checks the sea to a great distance. It is very serpentine, and often above 100 feet deep. Its sides are bluffs often 200 feet high.

The same springs originate the Missouri to the East, and the Columbia to the West in the rocky mountains, in lat. 45° 10′, and 110 W. long. For 6 miles the Missouri passes between rocks 1200 feet high, and in 18 miles it falls 357 feet, one fall being 87 feet perpendicular.

For the last 500 miles, the Amazons falls but 10·5 feet, and then but 5 inches per mile. The Ganges but 4 inches per mile. The Wolga 5 inches. The Rhine 2 feet per mile. In the Amazons, the bore of the tide is 180 feet.

The vast tract of land between the Andes and the Atlantic is so level, that, in 300 miles the river Paraguay does not fall above a foot. Three rivers fall into the estuary of fresh-water, called the Rio de la Plata; which, at its efflux, is 150 miles broad, and 30 miles over, opposite Buenos Ayres. At 200 miles distance, it receives several rivers besides the Paraguay, and this receives the Parana and Aruguay.

The country near the Oronooko, and its tributary streams, is flooded in the rainy season to a vast extent; and the Oronooko, near its mouth, expands over the land in June, July, and August, 5 or 600 miles.

The Leven, from the basin of Loch Lomond, discharges 59,939 cubic feet per minute, and as 36 cubic feet of fresh water are very near equal to a ton, this gives 1665 tons per minute.

Anciently the Adige and Po overflowed their banks, and committed great ravages; embankments were resorted to, but the beds filling up, the banks have been so raised that the rivers now flow 50 or 60 feet above the level of the country, and are rising!

Mackenzie River being closed at its outlet, by frost, nine or ten months in the year, causes great floods in the interior, and great destruction of forests, &c. so that it forms vast beds of water-loaded wood in the icy ocean, and generates the lakes of Canada.

The water-fall of the Ache, in Bavaria, is 2000 feet. Of Garispa, in India, is 1000. Of Bogota 800. Of Niagara 164, and 150 feet, but 635 feet broad. Of the Lulca, in Lapland, 400 feet, and 650 feet broad.

The Columbia, which runs into the Pacific, is 1500 miles long, and there are 3 others of 900 each. The largest into the Atlantic, in the United States, are the Savannah 700, the Potowmac 620, and 14 others exceeding 200 miles, and equal to the Thames.

Back's River was traced 600 miles to the Frozen Ocean.

The land always falls in the course of rivers. When straight in maps, they indi-

cate a plain country, and when winding a district of hills.

The Euphrates has been navigated nearly 1000 miles, from Bir to the Persian Gulf.

If all the rivers in Europe be as 1 000; those which flow into the Black Sea are 0·273; and the Mediterranean 0 144.

River-water contains about 28 grains of solid matter to every cubic foot. Hence, such a river as the Rhine carries to the sea every day 145,980 cubic feet of sand or stone.

In and near the Arctic regions, owing to the freezing of the springs, great rivers are dry in winter beneath a slender surface of ice.

Rennel thinks the mud of the Ganges, carried in the flood season into the sea, is equal to 74 pyramids of Egypt, but Lyall reduces it to 1 pyramid. Rennel thinks the mud a fourth of the water.

The silt, or mud, of the great rivers in India, precipitated by the annual inundations, is the chief cause of fertility, for the high lands yield many crops only every 4 or 5 years, while the flooded lands yield perennially. This silt is 1 per cent. water, 2½ vegetable matter, ½ muriate of potass, 7 or 7½ carbonate of lime, ½ phosphate of lime, 6 oxide of iron, 5 alumine, and 78 silex. The high lands have not 1 per cent. of carbonate, and to the excess in the silt is ascribed the fertility. The floods rise in July, and descend in August.

Rivers raise their bed by sediment, and would always overflow, but for the rise of the land, and when this is less than the sediment a river acquires new channels.

If the detritus, or shifting ballast of the Earth, is taken at a fourth of the surface, or 50 millions of square miles, ¼ of a mile deep, or 12·5 millions of cubic miles, then 0·36 per day, carried down by rivers, would be 131 cubic miles per annum, or 12·5 millions in about 95,000 years, so that in every 95,000 years, the shifting or soluble land would pass through the sea and form new beds on its solid base by the simple solution of rivers. What an element of silent change, and what a cycle would be many such changes! Tides, &c. however, accelerate it, and more violence is visible in the results than permits this to be the only cause.

Lakes vary in size continually from dessication, and their extinction forms basins of organic remains.

Water presents the most remarkable phenomena in Canada. Fresh-water lakes abound every where, and several are of vast extent :—

Lake Ontario is 160 miles long, and 450 round, and several hundred fathoms deep; the soil around it being volcanic.

Lake Michigan is 300 miles long, 60 broad, and 900 feet deep. The Peninsula which it forms with Huron and St. Clair contains 36,000 square miles, and that with Superiour 2000, with black loam 30 deep.

Lake Superiour is 420 miles long in diagonal, 170 broad, 900 feet deep, and 624 feet above the Atlantic at high-water, or 64 feet above Lake Erie.

Lake Huron is 280 long, 90 to 100 broad, and 900 deep.

Lake St. Clair is but 24 miles long, and 30 broad, with a depth of 20 feet.

Lake Erie joins the Huron by the Detroit 25 miles, and the St. Clair 40 miles. Lake Huron joins Superiour by the St. Mary 50 miles, and Michigan by the Mackinaw 40 miles, and 4 to 6 wide.

The Lake of the Woods is 75 miles long, and 200 round. Lake Winipig is 200 miles long, and 550 round. Lake Bourbon is 80 miles long, and 230 round. The Great Slave Lake is 200 miles long, and 500 round. Champlain is 120 miles long, and 300 round.

The river St. Lawrence, with which most of these lakes are connected, is one of the largest in the world, being 2500 miles long, navigable for the largest ships to Quebec, 400 miles; and for ships of 4 or 500 tons to Montreal, while fleets sail on the Lakes.

The communication between these and the sea is intercepted by the great waterfall of Niagara, between Lakes Erie and Ontario, but a canal has been formed. The river is the third of a mile wide, and the fall takes place in three cataracts, made by two small islands, 150 feet; the roar of which is heard 15 miles, while the vapour may be seen for 60 or 80 miles.

Since the banks of the Cataract of Niagara were inhabited by Europeans, the distance has been progressively shortening between the Falls and Lake Erie. When it has worn down the intervening calcareous rocks, and effected a junction, the upper lake will form an extensive plain.

There is also a fall on the Montmorenci, 200 feet in breadth, and 246 feet high; besides others, which in many countries would be remarkable.

The shores of the lakes, and the cliffs around the lakes, often exhibit remains of fallen forests, 30 or 40 feet below the level of the surface of the country.

Lake Baikal, in Siberia, is 300 miles long, between 51° and 55°. The lake of Titica, near Potosi, is 12,800 feet above the sea, and covers 16,000 square miles.

That intelligent traveller Madden, visited the Dead Sea. "I was desirous of ascertaining the truth of the assertion, that 'nothing sinks in the Dead Sea,' and I swam a considerable distance from the shore. About four yards from the beach I was beyond my depth, and the water was the coldest I ever felt. No living creature is to be found in the Dead Sea. The aspect of the mountains, the terrible ravines, the romantic forms of the jagged rocks, all prove that the surrounding country has been the scene of some terrible convulsion of nature, and that the sea, which occupies the sites of Sodom and Gomorrah, Adan, Seboim, and Segor, covers the crater of a volcano. The water gave the following analysis:

Oxy-muriate of soda	grains	9 58
———— magnesia		5 28
———— lime		3 05
Sulphate of lime		1 34

There is no visible outlet to the lake, not-

withstanding the Jordan daily sends into it six millions and ninety thousand tons."

Springs are formed by the intervention of clay and sand strata, the former holding water and the latter permitting its free passage. So that, in well-digging, there is no water till clay is penetrated quite through.

Springs of fresh-water arise in most seas, and some on our coasts. Near Cuba there are remarkable ones.

About thirty fresh-water springs are discovered under the sea, on the south of the Persian Gulf.

St. Winifred's Well throws up 120 tons in a minute, and, in a mile and a furlong, turns 11 mills with great power.

As springs run from high levels to low ones, so they seek to rise again to the first level, and hence the great force in ascent in most cases, especially after boring.

Springs are the sources of rivers, which are fed by rivulets and other rivers till they form wonders on the globe.

Springs that flow through limestone rocks deposit vast quantities of calcareous tuffa and sinter. Other springs deposit silica.

The *Acidulous* springs are Seltzer, Pyrmont, Spa, and Carlsbad, which last is 165°.

The *Sulphureous* are Harrowgate, and Aix-la-Chapelle, which last is 143°.

The *Saline* are Sedlitz, Cheltenham, and Plombieres.

The *Chalybeate*, Tonbridge and Toplitz.

The *Calcareous* are Bath, 114°; Buxton, 82°; Bristol, 74°; Matlock, 66°.

Thirty-eight several substances have been found in various mineral springs. The acidulous abound in carbonic acid. The chalybeate in iron. The hepatic in sulphuretted hydrogen. The saline in salts.

The mineral waters of England are *Alteratives*, Buxton, Matlock, Malvern. *Aperients*, Harrowgate, Cheltenham, Leamington. *Tonics*, Bath, Tunbridge, Cheltenham.

The Bath waters contain but the sixth of a grain of iron in a gallon, and some silica and azote. A gallon of Tunbridge contains 2·29 grains of oxide of iron, 8·05 of carbonic acid, 4·75 of azote, and 5 of oxygen.

The hot-baths of Bath range from 96° to 115°, and generate 223 cubic feet of gas, chiefly nitrogen, per day. Bristol or Clifton hot-wells water is 74½ degrees, and its specific gravity 1·00077. A gallon contains 43¾ grains of sulphate of soda, sulphate of lime, and carbonate of lime, and four grains of muriate of soda; also 30 cubic inches of carbonic acid gas.

Buxton water is 82 degrees; and a gallon contains 11½ grains of calcareous earth, 2½ of vitriolic selenite, 2 of sea-salt and azote.

The waters of Aix la-Chapelle contain 4·75 carbonate of lime, 5 muriate of soda, and 12 carbonate of soda. The gas is sulphuretted hydrogen.

Nitrogen gas issues in almost a pure state from the earth on Bradt's farm, in Rensselaer county, New York; from every part of a low hill, comprising four or five acres.

Sulphuric acid rises in large quantities, both in a dilute and concentrated state, in Byron, Genessee county. The place has long been known in the vicinity, by the name of *the sour-springs.*

Hot-springs, forming vast deposits of calcareous rocks, abound on the north of the Himalayas, and their deposits display the highest antiquity.

Iron, in springs, binds together the sand and gravel into solid masses, and the carbonate forms chalybeate springs. Carbonic acid gas is largely disengaged from springs, and decomposes the hardest rocks, especially feldspar, and even granite.

A petroleum spring, in the Birman Empire, yields 400,000 hogsheads per annum, and there are others in Trinidad, Italy, &c.

Calcareous springs hold carbonate of lime in solution, and more when impregnated with carbonic acid, which, being dissipated, the lime is precipitated as tufa and travertin. At San Felippo, the deposits in a pond are 30 inches per annum. The lake of Solfaterra contains more than its own volume of carbonic acid gas, and some sulphuretted hydrogen. The banks are covered with reeds, lichen, conferva, &c. and the edifices of Rome are built with the travertin.

The great Geyser rises out of a basin 56 by 46 feet over. The pipe in the centre is 78 feet by 8 or 10.

To explain all the past changes and their system of consecutive change, the Editor refers to the Earth's motions as a Planet, and to the varied direction of the forces at distant regular epochs. He considers mobile water as the first patient of change, and its conveniently variable quantity as the tool by which reactions are effected. He finds, too, that motions of water are the sufficient general cause of all geological phenomena. If the planes of the Equator and Ecliptic coincided, if the orbit were a true circle there would be no element of change. But the orbit is elliptical, and geometry demands an increase of projectile force in the Perihelion. Water then alone is the means of conferring it; and in proof, at this time, we find the perihelion progressing through Southern signs, and, in coincidence, we find the waters in the Southern hemisphere to those in the Northern as 436 to 290, or as 3 to 2. Then, if the perihelion progress through the Ecliptic in 10,500 years into the same declination North, and the physical cause and effect go together, the seas in the Northern hemisphere *cæteris paribus* will be to those in the Southern as 3 to 2, consequently, all the vallies and secondary elevations in the Northern hemisphere will be submerged for many thousand years, and be subjected in advance and retreat, to tidal action, and to all the energies and actions of this changing, destroying, and re-forming agent. At present, the Southern hemisphere is in the proportion of 436 water to 64 land, and the Northern is 290 water and 210 land, the excess of water in the Southern hemisphere being 146 parts over the water in the Northern hemisphere, and the excess of the land in the Northern over the land in the Southern

hemisphere being also 146 parts. The difference is demanded by greater and smaller forces in perihelion and aphelion. In relation to the whole Earth of 726 water and 274 land, *i. e.* a mean of 363 and 137 in each, we find the water in the Southern 73 too much, and the land 73 too little; and in the Northern the land 73 too much and the water 73 too little. These coincidences are proofs of the principle, if proof were wanted of a cause and effect, so obvious, and on which all the observed phenomena are a running commentary. The data, however, taken at the present obliquity, lead to the conclusion that this change in the expansion of the waters would be accompanied by an increase in the mean depth of a third—that is, if the mean is 2 miles, there would be 3520 feet of elevation, and if 3 miles, 5280 feet, covering nearly all the hills in the British islands.

The reader, in considering this theory, must carefully discriminate between the progression of the line of apsides, or of the perihelion and aphelion distances, (3 millions of miles different) in 20,931 years; and the mere precession of the equinoxes, or advance of the stars in 25,678 years.

The secondary and tertiary strata, and their diluvial and alluvial remains, are as plain a commentary on this theory, as any natural phenomena could afford. The newest tertiary strata were formed in the last progress of the perihelion through the northern signs, between 6 and 16,000 years since; the 4 other series at other intervals of 20,900 years, rendering the period of the tertiary formations about 93,000 years. The secondary formations, at least 10 in number, may be referred to 10 northings of the perihelion, or 213,000 years. The transition periods may include 20 others, making together 600,000 years. On granitic and gneiss periods, when the earth was as barren and desert as the moon, it would be idle to speculate. Buckland assigns to the whole, a million or millions of years.

Three hydrological accidents may have led to that irruption of waters which caused the transfer of an ark from Syria into Armenia, about 3 or 400 miles N. E. 1. The bursting of the pillars or embankments of Hercules, by which the Atlantic would inundate all the shores of the Mediterranean, till the waters expanded and settled. 2. The bursting of the Bosphorus, which would drain the channels across Poland to the Baltic and the channels to the Caspian and Aral. 3. The Bursting at Syrtis of the isthmus which confined the great African sea, whose remains fill the Deserts of Lybia, &c. Noah, the 10th patriarch of the Jews from Adam, or Xisuthrus the 10th king of Western Asia, from Alorus or Orion, were no doubt identical, for Xisuthrus resided at Sipporah, north of the sea of Galilee, and Noah's tomb is shewn in the same country, and he is said to have lived in Cœlo Syria, the valley between the Lebanons. The accounts in Genesis, and the Laws of Menu, agree exactly except in some miracles in the former. Several ancient writers refer to the catastrophe and ark of Xisuthrus. Rain could not have been the cause, since all the vapour in the atmosphere would form in water but a depth of 13½ inches. Comets were the bugbear, till it was found that a star of the 15th magnitude could be seen through their centre, and that their tails are only light reflected through them.

There can be no doubt but an irruption of the Atlantic separated Britain from the Continent, and that the Irish Channel has also been formed by successive irruptions. The Welsh Chronicles record when Cardigan Bay was a fertile district, and the Irish, when the Scilly Islands were separated from Cornwall. Ancient maps and the salt-beds in the line, indicate on the contrary, that the estuaries of the Severn and the Mersey were once joined by a tidal channel of salt-water.

Our eastern coast, from Sutherland to the Humber, is encroached upon: villages have been absorbed, and the encroachment is four yards per annum. Ravenspur, Hyde, &c. have long disappeared, and Spurnhead is in danger. At Sheringham, the encroachment is two yards per annum. Ancient Cromer is in the sea. Hills of blown sand protect other parts. Dunwich, a considerable town and port, has now but twenty houses. Aldborough is now sea, and Harwich will soon be an island. Sheppy is fast disappearing. Thanet loses a yard per annum.

Submersion, currents, and tides, during perihelion periods, have transported rocks of part of England to other parts, for water reduces specific gravity, and a velocity of 32 feet per second, or double that of a common tide, would carry rocks like wood or cork. Local beds of gravel would be products of tidal action in bays, both in the advance and retreat, in respective periods of 3 or 4000 years.

The beautiful lake of Geneva is contracting, and the lakes in Lincolnshire and Cambridgeshire have become dry in our days. The marine palace of Canute is now near Ramsey, twenty miles from the sea.

The sea of Arad is 290 miles long, and from 130 to 200 broad. The Jaxartes and the Oxus flow into it. In level it is 16 feet below the Black Sea; but above the Caspian. Within memory, it has shrunk 40 miles all round, and left salt-pits, while it is now half filled with sand-banks.

Lyall confirms the prevailing belief that the bottom of the Baltic rises. It must, however, be difficult to decide between the rising of the land and the retreat of the waters, and the latter is far more probable.

Hungary, if not Poland, was the basin of a lake or sea.

Fish are common in the seas of Surinam with 4 eyes, 2 of them in horns which grow on the crown of their heads.

The petrifying powers of the waters of Lough Neagh still continue, and arise from silex brought into it by its brooks.

The German Ocean was once an estuary of the Rhine, the Elbe, Thames, and Humber. Hence those animal bones not indi-

genous, and the sand-banks of the German Ocean. The irruption of the Baltic is mentioned by Aristotle, and in the Welsh Triads.

The marine valley which separates Britain from Holland is not 100 yards deep.

The similarity of fishes and aquatic plants in remote lakes and inland seas, is proof of the alternate submersion of both hemispheres, by varied declinations of the perihelion.

Owing to the Atlantic tides the Western coasts of Ireland, England, and Scotland are indented by bays.

At 40 feet below the surface of the sea *ulvæ* disappear, at 60 feet the *ceramium*, and at 100 feet depth all vegetation is generally superseded by polypes and testaceæ.

The geology of England and Wales, is evidence of the flow of water from the W. and N. W. The western coast consists of rocks of a lower level, and the country to the east even to the shores, is palpably covered by the debris of elder and lower formations.

In Ireland there is the same evidence as in England, of floods from N. W. to the S. E. in producing the ranges of formations.

The Tides.

Of all natural objects, the expanded sea is one of the most gratifying and sublime; and of all the phenomena of motion, its librations, or tides, conferring on the whole the activity of life, are the most surprising. They are a perennial commentary on the various motions and forces, of which the sphere of the Earth is the patient; and the pliancy of the parts enables us to contemplate the reactions, by which are maintained an equilibrium too vast in size for human cognizance.

But what a bathos is that credulous philosophy, which has too long presumed to sink these interesting causes and effects in the execrable gossip of the dark ages about lunar attraction! Are we, under the influence of such culinary reasoning, to abandon our sublime association of the coming and departing waves, with the scheme of Nature, which in moving every thing, also moves the vast ocean, and in it presents a glorious picture of the one secondary cause of all phenomena in the transfer and continuity of motion.

The Ocean rises and falls alternately; and its depth is observed to be greatest at any given place, a certain time after the Moon has passed the meridian of that place; after which it decreases until it reaches a certain point, when it again gradually rises. The interval of time between *low* water and the following *high* water is called *flood tide*, and that between *high* water and the following *low* water is called *ebb tide*. There are generally, or on an average, two high tides in one lunar day. The period of the Moon's mean conjunctions is 29·530588716 days. The interval between successive high tides is 12 h. 24 m. 22 s. A quarter is 7 d. 9 h. 5 m. and 45·6 s. The Moon moves through 13·177° per day. The orbit from star to star is 27·32 days.

The interval, however, which elapses between the Moon's southing, and the time of high water, is very irregular, and depends upon her angular distance from the syzygy; also upon the distances of both luminaries, and their declinations. The variations are greatest when the Sun's distance from the Earth is greatest, and the Moon's distance is least; and when the Moon's declination is greatest, and the Sun's declination least, as in the equinoxes.

The *heights* of the tide at high water also vary; they are greatest soon after the Moon is in syzygy, and least soon after she is in quadrature; the one are called *spring*, the other *neap* tides. These heights depend also upon the declinations and distances of the luminaries. The time of high water at any port when the Moon is in syzygy (new or full), is called the Establishment.

The unit of altitude of the tides at any place is the heighth a day and a half after the new or full moon, *i. e.* 3 tides after. La Place determined the ratios of each new and full, in a year, to that unit.

The Bay of Fundy gives units 50, 60, and 71 feet, whilst Charleston and Augustines give but 6 and 5, and Cape Henry but 4½, New York 5, and Halifax 8. At Anapolis it rises 100 or 120 feet.

All narrowing seas which compress the sides of a current as it advances, create greater units. Of this the 50 foot tide at Chepstow, at the end of the funnel of the Bristol Channel, is an example. Bores in narrowing rivers arise from the same cause.

Tides differ so much yet so regularly in various angles and distances of the Earth as to the Sun, that *Bouvart* has made a table of factors for multiplying the mean heighth at the different *Syzygions*. The highest factor is in September 1·13, and in March 1·12, the lowest in January, February, July, and August 0·76.

The great exciting energy of the waters is the Tides. Twice in every rotation the seas rise and fall from 4 or 10 to 40 or 60 feet, and they act on all shores like librating water in a shallow vessel. They are connected with the Moon, since they follow the Moon's southing in time, however they may be specially obstructed and delayed. Attraction is absurd—the waters *rise*, and the Moon does not descend beneath them to push them up. To understand it, we must consider the unity of the system of the Earth and Moon. They go together round the Sun, and act and react through a point which is the centre of their relative momenta. That centre performs the solar orbit; and around it the Earth performs a terro-lunar orbit 5043 miles distant (10¼″ of parallax at the Sun) and the Moon an orbit of about 237,000 miles. In these reciprocating orbits, like a large and a small ball at the two ends of a balanced lever, they move contrary ways, and the intervening point or fulcrum goes round the Sun. At Full the Earth is 5043 miles, or 10¼″, as to the Sun, in

the interior of the solar orbit; and at the New Moon as much on the outside.

The Earth's fixed parts concur, but the *mobile* waters seek the fulcrum, which is the centre of the greater force. Hence the spring-tides at New and Full. In the Quarters, the Earth, Fulcrum, and Moon move in the Solar orbit, and the action is a continuation. But a tide on one side disturbs the balance of the sides in rotating, while all the motions fix the centre. It is easier, therefore, for water to flow to restore the balance of the two sides; and, hence the second or opposite tide. It is a mechanical action of a fixed mass with a mobile adjunct, and the adjunct keeps up the equilibrium. Of course, the fulcrum is in the line that joins the centres of the Earth and Moon, and as the Tides rise towards the fulcrum, they appear to rise towards the Moon which is in a line beyond it.

With reference to the solar orbit of the Fulcrum, the tract of the Earth is a wavy line, which crosses the true orbit twice in every lunation, once to the outside and once to the inside, gradually deviating for 7·396 days to about 10½ seconds, or above 5000 miles, and then gradually returning. The mobile waters, of course, respect the centre of greater force in the Fulcrum orbit, and in seeking to revolve round it, generate on that side the accumulation of the Tides in the direction of the Fulcrum and Moon. But, as rotation implies equality of opposite sides of the Earth, and the centre is determined, so an accumulation on one side creates another flow on the opposite; hence, two Tides during a rotation.

If we can divest ourselves of the witchcraft of attraction, and the pedantic display of irrelevant mathematics, we can have no difficulty in understanding the Tides. But we must look to facts, and avoid the closet fancies of those who never saw a Tide.

The waters rise, and the waves break over one another on sea-coasts, but the whole is only superficial. They flow 6 hours, and ebb 6 hours, at rates of 4, 6, or 8 miles an hour, the range being from 24 to 50 miles. The same water, to the depth at most of 3 fathoms, seldom 4, performs this race twice a day. A boat, or any floating body, drifted by the tide, goes and comes with the same water. The edges of the water librate both in the advance and retreat, and the dashing of waves is caused by an advancing wave tumbling over a retreating one, assisted by wind acting on the tops of the waves.

Now all these appearances belong only to the coasts or edges of the great basin of the sea, or to any rock, bank, or island, acting as obstructions in the middle. Free, open, expanded, the sea displays none of the appearances on a coast, and yet from these we draw our general deductions.

If, as an experiment, we put water into a shallow vessel, and then raise its sides alternately, the water at the sides will shew what happens on sea-coasts, and the water at the middle will be as quiescent as large open seas in their middle. Let the bottom of the vessel be made unequal, and put rocks, &c. near the edges, and you have a closer imitation of the Tides.

In fact, the course of the Earth inside and outside of the Fulcrum orbit, and the crossing of that orbit, is a natural oscillation of the mass performed twice a month, which oscillations are not apparent in the rocks, strata, and mountains, but only in the mobile waters, and it is this which constitutes the Tides. The Earth, like the vessel, oscillates to the waters, or the waters librate in their oceanic basins; hence all the phenomena, when the libration is gradually or suddenly obstructed by coasts.

The variations in times, the springs, the neaps, &c. &c. &c. depend on the curve which the Earth is describing in regard to the Fulcrum orbit; and its daily varying position as to that orbit, as near or remote, on the inside or outside, in the plane or out of it, acting causes more or less distant, &c.

Spring tides, of course, arise from an impulse of the waters towards the Fulcrum as radius of the Moon's orbit; and then there is a fall in a ratio of the *sine* of the deflection till the quarter. The sine then enlarges till again equal to the radius. The other half of the orbit is performed in like manner, decreasing to the quarter, and increasing to the syzygy. Except from declination, distance, &c. the heighths follow the table of sines with convincing precision, in situations where the effect is least disturbed by reactions, deflections, &c.

When Wallis, in a nascent theory something like this, supposed a difficulty about connexion, he did not consider that the Earth and Moon move in *contrary* directions round the solar Fulcrum, and having equal momenta, one is as worthy as the other. In nature, there is no up or down, and the rarest intervention is efficient.

In considering the Tides, we must never lose sight of the fact that a tide everywhere is + and — about 40 miles. The retreat is equal to the advance, and the limit of both is about 40 miles, even in narrow seas. What is meant then by great tidal waves, which go round the world in two or three days, we are at a loss to imagine. The maps of them will be monuments of the folly of theory, and of the folly above all of the silly theory of lunar attraction with which such dreams are associated. We have looked at the sea for three-score years, and we have read three-score voyages round the world, but we never saw, or read of any one that beheld these great tidal waves!

Of course, as water seeks its own level, and moves till it does, so we have tides in the British Seas excited by the librations of the Atlantic, but whether the propulsion proceed up the British Channel, the Irish Sea, the Bristol Channel, or on the Western coasts of Ireland, the 40 miles + and — prevails, and there is no great Atlantic wave broken into three parts, and flowing onward 1 or 200 miles an hour.

There is, however, a mixture of some facts with error in the following by

Whewell, and for the sake of the former it is introduced.

"The great tidal wave of the Atlantic reaches the mouths of the British seas about 4 hours after the southing. It is broken into 3, up the English Channel, the Irish Channel, and the West of Ireland. It reaches in the first direction the Nore in 8 hours, and in the second and third it arrives at the Orkneys in 5 hours; in other 3 hours reaches the Naze of Norway, but it employs other 8 hours to reach the Nore, and there meets the Channel tide of two previous original tides, *i. e.* in 28 hours' motion it passes round the island."—*Whewell.*

The second tide is an experimental proof of the two motions, and of the necessary balance of the two sides in rotating. It also illustrates the mechanism of a primary and secondary, and altogether is a fine problem.

The sun also tends to create a tide, by the difference between a solar and sidereal day, as was explained by Galileo and Wallis, equal in theory to 69 miles per day.

It is generally high water 30° to the east of the moon, and of her antipodes.

At new and full-moon, at the London Docks, spring-tides rise to 24 feet 1 inch; then, in 7 days, fall to 18 feet 9 inches, or 5 feet 4 in. less, or neap-tides; after the quarter they rise again to 22 feet 8 inches, fall in the next quarter to 19 feet, and then rise to 24 feet.

On the day of the NEW MOON, high-water in the *morning*, at LONDON-BRIDGE, varies between 2 hours 20 minutes, and 1 hour 50 minutes. And in the *afternoon*, between 2 hours 12 minutes, and 1 hour 48 minutes.

At the FULL in the *morning*, high-water varies between 1 hour 51 minutes, and 2 hours 17 minutes. And in the *afternoon*, between 2 hours 19″, and 1 hour 32″.

At the FIRST QUARTER, high-water in the *morning* varies from 6 hours 44 minutes, to 7 hours 21 minutes. In the *afternoon*, from 7 hours 48 minutes, to 6 hours 34 minutes.

In the LAST QUARTER, in the *morning* from 7 hours 20 minutes, to 6 hours 39 minutes, and in the *afternoon* from 6 hours 30 minutes, to 7 hours 12 minutes.

These, however, are approximations, and accuracy can be obtained only by consulting an almanac for the year. But relying on the above, 53 minutes is to be deducted for every day, for difference of time.

Time of high-water, when the Moon passes the Meridian at Twelve o'clock, her parallax being 57′, and her declination 15°.

	h.	m.
London Docks	1	57
Sheerness	0	39
Brest	3	48
Plymouth	5	33
Portsmouth	11	40
Ramsgate Harbour	11	46
Pembroke Docks	6	4
Liverpool Docks	11	22
Howth Harbour	11	8

From more than 24,000 observations of the Tides at the London Docks, the interval corresponding to the Moon's transit is at 3 h. 30 m. = 2 h. 26·7 m., at 9 h. 30 m. = 3 h. 50·4 m. The difference = 1 h. 23·7 m.

From the Liverpool Tides, with reference to transit, the interval corresponding to the Moon's transit is at 3 h. 0 m. = 11 h. 41 m. at 9 h. 0 m. = 13 h. 2 m. The difference = 1 h. 21 m.

When the moon is in Syzygy, the primary tide arrives as under:—

	days	hrs.	min.
At Brest	1	4	27
Plymouth Dock	1	6	12
Portsmouth Dock ..	1	12	51
Pembroke Dock	1	6	42
Bristol C. G.	1	7	53
Liverpool Dock	1	12	2
Howth	1	11	4
Leith	1	15	5
Sheerness	2	1	48
London Dock	2	3	13
London Bridge	2	3	23

The great and least heights in feet are as under, at different ages of the moon or period of transiting the meridian.

	Syzygy.	Qrs.
London Dock	22·32	19·39
Sheerness	25·63	22·96
Bristol	32·23	21·72
Leith	16·29	12·58

At the following the lowest is 30 minutes after the quarters.

Portsmouth	19·69	16·65
Pembroke	22·77	17·29
Liverpool	17·57	12·32

The variations from lunar parallax is about 1·66 foot. From solar but 0·15 foot, from moon's declination but 1·2.

At the London Docks, high-water follows the Moon's southing by day, between 39 minutes and 2 hours 22 minutes, mean 1 hour 32 minutes, according as wind and the state of the river permits. The mean in January is 1 hour 44 minutes, in February 1 hour 48 minutes, in March and April 1 hour 21 minutes. In May and June 1 hour 33 minutes, and 1 hour 38 minutes. In July, August, and September 1 hour 43 minutes, 1 hour 40 minutes, and 1 hour 35 minutes; in October, November, and December 1 hour 13 minutes, 1 hour 27 minutes, and 1 hour 26 minutes.

By the mean of 18 years' observations, it appears that when the Moon souths at 26 minutes, the high-water takes place 2 hours 23 minutes, or 1 hour 57 minutes after, and when at 1 hour 22 minutes, the high-water takes place at 3 hours 3 minutes, or 1 hour 41 minutes, after the southing.

The mean time of high-water at the New and Full Moon, at the LONDON DOCKS, is 2 hours 2 minutes, and 10 minutes are added for LONDON BRIDGE.

As the Moon souths, high-water follows, thus:

12 o'clock	1 h.	57 m.	6 o'clock	0 h.	42 m.
1 ——	1	42	7 ——	0	52
2 ——	1	26	8 ——	1	23
3 ——	1	11	9 ——	1	56
4 ——	0	56	10 ——	2	10
5 ——	0	45	11 ——	2	5

N. W. winds vary the Tides at the London Docks about 12′, W. 7′, and other winds less.

When the distance of the Moon and Earth from the fulcrum is greater, and parallax less, the Tides are later, as at 54′, 8′ or 9′ later at a mean; at 57′ the mean, but at 60′ as much earlier as 54′ later.

The Moon in the Equator postpones the time of high-water from 5 to 19 minutes, and this decreases to 15° of Dec. the mean. But, from 15° to 27°, the high-water is as much earlier, even 20 minutes at 27°.

It appears, by observation, that where a spring-tide is 10, the abatement of the cause in the quarters reduces it to 4½.

As the same water makes the flood-tide at different places, so a great flood causes great ebbs at the same time.

In the middle of the Pacific the spring-tides are 5 feet, and the neap 2 or 2½ feet.

As the Moon advances in her orbit 13·177 degrees, R. A. per day, so she souths on every meridian a mean of 52·7 minutes of time later, varying as to declination and latitude. Then, as the libration creates Tides only when she is about 2 hours from the meridian, so the Tides at a mean must be 52·7 minutes later one day than the preceding. As matter of fact, there is at high and low-water a stationary time, which repeated four times a day, is about equal to the two hours lost. The propulsion of the libration in mass, then acts on the superficial parts whose motion is the tide of shores and narrow seas.

The differences of Time of High Water between London and the Ports of the United Kingdom, and some Foreign Ports.

		h.	m.
Aberdeen	sub.	1	31
Alderney	add.	4	29
Antwerp	—	3	26
Ayr Harbour	sub.	2	31
Bantry Bay	add.	1	29
Barnstaple Bar	—	3	14
Blakeney Harbour ..	—	3	44
Blexen	sub.	0	46
Boulogne	—	3	46
Brest Harbour	add.	2	14
Brighton	sub.	3	1
Brill, the	—	1	2
Buchan-ness	—	2	16
Calais	—	2	46
Campbeltown	—	2	46
Cape Clear	add.	1	44
Cardigan Bar	—	4	59
Carmarthen Bay	—	4	2
Cherbourg	—	5	29
Christchurch Harbour ..	sub.	5	26
Cork Harbour	add.	2	14
Cowes	sub.	3	31
Cromarty	—	2	31
Cuxhaven	—	1	16
Dartmouth Harbour ..	add.	3	44
Donegal Bar	—	2	49
Douglas Harbour, Isle of Man,	sub.	3	46
Dover Harbour	—	3	1
Dublin	—	3	31
Duncansby Head	—	6	17
Dunkirk	—	2	31
Exmouth Bar	add.	3	44
Eyder, Mouth of the ..	sub.	2	16
Falmouth Harbour ..	add	2	59
Flushing (Walcheren) ..	sub.	0	56
Fort George	—	2	16
Galway	add	1	59
Glenluce Bay	sub.	3	16
Gravelines	—	2	31
Greenock	—	2	31
Guernsey	add	4	14
Hartlepool	—	0	59
Havre de Grace	sub.	3	46
Heligoland	—	3	16
Hellevoet Sluys	—	0	1
Holyhead Harbour ..	—	4	32
Horn Point	—	2	16
Hull	add	3	59
Hythe	sub.	3	11
Ilfracombe	add	3	14
Jersey	—	3	54
King's Road	—	4	29
Kinsale Harbour ..	—	2	14
Leith	—	0	4
Lerwick Harbour ..	sub.	4	31
Little Hampton	—	3	1
Liverpool	—	2	54
Ditto, Rock Perch, entrance to	—	3	16
Loch Foyle	add	4	14
Margate	sub.	3	1
Milford Haven, entrance to	add	3	29
Montrose	sub.	0	46
Morlaix	add	2	59
Mount's Bay	—	2	14
Newhaven	sub.	3	16
Newport, (Isle of Wight)	—	2	1
New Shoreham Harbour	—	3	2
Nore Light-vessel	—	1	18
Orfordness	—	3	46
Peel Harbour, Isle of Man	—	3	46
Pembroke Dock-Yard ..	add.	3	48
Plymouth Sound	—	3	14
Port Glasgow	sub.	2	31
Port Patrick	—	3	16
Portsmouth Harbour ..	—	2	36
Ramsay Harbour, Isle of Man	—	3	46
Ramsgate Harbour ..	—	2	30
Rye Harbour	—	3	40
Scarborough	add	1	50
Scilly Islands	—	1	54
Shannon Mouth	—	1	29
Sligo Bay	—	2	59
Southampton	sub.	2	46
Southend and Sheerness ..	—	1	47
Spurn Point, the	add	2	59
St. Ives	—	2	14
St. Malo	—	3	44
Stromness	sub.	5	16
Sunderland	add	0	44
Tay Bar	sub.	0	31
Texel Road	add	6	44
Torbay	—	3	44
Tynemouth Bar	—	0	34
Waterford, Hook point of	—	2	59
Wells Harbour	—	3	44
West Scheldt, entrance ..	sub.	1	31
Whitby	add	1	14
Wigton Bay	sub.	3	16
Wranger Oog	—	2	16
Yarmouth Road	add	6	26

Add or subtract the times in the above from the time of High Water at London

The tides are greater when the re-action of the moon is vertical to the Equator. The chief tide is on the same side as the Moon.

Volcanoes and Earthquakes.

The mixture and confusion of materials which compose the crust of the Earth, and the great internal heat, necessarily generate combustion, and also create various gases in caverns and hollows, whose expansion rends the incumbent rocks and strata in earthquakes, while in some instances, where the materials are abundant, they give rise to vents called volcanoes.

This chemical fermentation shews itself in various forms. Sometimes in mountains, where there is access of air, and the water of melting snows, or communications with the sea. At other times, in hot springs, in emissions of carburetted or sulphuretted hydrogen, in vents, explosions, and consequent vibrations of the strata, called earthquakes. As they may be imitated in various compounds, there is little to surprise in them, though much to dread, from their destruction of human structures, and the terrific magnitude of their devastations.

They generate peculiar mineral products in lavas, pumice, basalt, sulphur, &c., and the appearance of these is always a proof that the scite has been volcanic. Water, by generating hydrogen, feeds, rather than smothers such vast masses of burning materials, and hence volcanoes under the sea are very common, and by generating greater volumes of steam, they are more extensive in their action even than volcanoes on land.

Taking volcanoes at 200, each operating on 100 sq. miles, they affect with their products 20,000 square miles, and if five times their existing number have become extinct it gives 100,000 sq. miles of volcanic products. This, however, would be only the 20,000th part of the earth's surface. They may enlarge a mountain, and their gaseous products may cause earthquakes and uplift beds of strata, but it is fanciful to refer to them the inequalities of the earth's surface.

Humboldt, a great authority on every subject, maintains that dynamical earthquakes, and chemical volcanoes, have their causes in the interior of the earth, and act through fissures and empty veins. He ascribes the mud and fishes, often distributed, to snow and lakes at the sides of volcanoes, and considers the matter properly ejected, as ashes and lava only. When the summit of Canguairazo, 18,000 feet high, fell in, 43 square miles were covered with mud and fish.

Volcanic action does not consist in the combustion of beds of coal, but in chemical operations, seated deep in the oldest formations. The hot-springs in Germany issue from gneiss, granite, and clay-slate.

Professor Daubeny ascribes earthquakes and volcanoes to the access of water to the inflammable bases of the earths and alkalies. When the explosion is single or double, and confined in a cavernous space, it is an earthquake; and when fed and supported by water, as in an elevation, it becomes a volcano. Humboldt and Davy also ascribe volcanoes to the oxydation of the bases of the alkalies and earths.

Just as water burns potassium, calcium, &c. so it heats all other alkaline bodies, by imparting its oxygen to them; and this union, and loss of bulk, is the cause of earthquakes, volcanoes, hot-springs, &c.

It is probably, also, a chief cause of subterraneous heat, since increase of temperature is the immediate result of the contact of water with any alkaline earths, alkaline states of metals, &c. When the fermentation is commencing, smoke appears; noises are heard; earthquakes take place; and explosions of ashes, sand, and stone, precede the flow of melted lava. The smoke consists of steam, and carbonic, sulphuric, or muriatic gas. The ashes appear to be exploded lava, and are often carried by the wind 1 or 200 miles. Thick accumulations form a compact stone, called tufa; and the scoria is like the slag of iron furnaces. The explosive force is such as sometimes to throw stones of 200 tons 8 or 9 miles.

All volcanoes appear to exist near a sea, and, by the matter they eject, to have some communication with it.

Countries, near mountains, are more subject to these effects, because water penetrates their sides to the secondary rocks. Where frequently, the escape of gas might be facilitated, by boring down to the granite.

Ships, by a sudden protrusion of the water, feel the blow as though they had struck on a rock. In this mechanical effect there is no indication of electrical action, and, in truth, the whole, beyond doubt, is a mere gaseous expansion under masses of strata. No doubt, also, the earthquake arrests for the moment, the librations of the unlying masses of water.

A line of granite hills has obstructed the action of an earthquake from one side to the other side, the tertiary and secondary strata being evidently those affected.

A single shock lasts a few seconds. The common occurrence of radiated rents in the ground points to the cause in confined gas. Caverns and hollows in the earth give way, and often swallow tracts, which fill up with water from the adjoining strata.

There is no evidence that volcanoes are so much as 5 miles deep.

The American volcanoes throw up chiefly slime and mud, with slag and ashes.

Primitive rocks are not near volcanoes.

With an inclination of only 6° no lava from a volcano can rest on its sides so as to increase the bulk, but in Etna, &c. the rise is 29° to 32°. The strata of tuffa round Vesuvius is not a product of the volcano, but a marine formation like limestone, and has its own crystals not volcanic. Von Buch says, the volcano forced its way through the tuffa. The hills are composed of trachyte, a coarse, splintery basis, in which are embedded crystals of glassy fel-

spar and augite. Cones of volcanoes are sudden elevations through casting.

Geological theorists assert, that the inequalities on the earth's surface arise from upliftings by volcanoes, earthquakes, &c. and to these they ascribe the inclinations of strata, &c. &c. But the minute seams in sandstones, and the parallelism of the strata in the same formations indicate that the whole is the effect of depositions and precipitations, while, in the submersions by the sea and the advance and retreat during perihelion periods, we have the aqueous agency required for the precipitations.

About 200 active volcanoes are recorded, of which 89 are in islands. Submarine volcanoes often throw up islands. The Azores, the Lipari, the Canaries, &c. are examples.

The ashes from volcanoes often produce total darkness from 30 to 50 miles round, and they often fall in showers from 2 to 300 miles distant. Pieces of rock are ejected with the velocity of a cannon-ball. Cotopaxi once threw a piece of 100 cubic yards 8 miles. Fish ejected from volcanoes are those of neighbouring waters.

Lava is a stony substance like basalt, and may sometimes be seen at the bottom of a crater red-hot, like melted metal, bubbling as a fountain. When it overflows the crater, it is very fluid. At Vesuvius, a red-hot current of it was from eight to ten yards deep, 2 or 300 yards broad, and nearly a mile long. In Mexico, a plain was filled up by it into a mountain 1600 feet high, by an eruption in 1759. Its heat was so great, that it continued to smoke for above twenty years afterwards; and a piece of wood took fire in lava 3½ years after it had been ejected, at 5 miles from the crater.

Stones of immense size rise to the height of 7000 feet, and others, darkening the air, fall 100 miles distant.

Thirty-one great eruptions of Etna, have occurred within the records of history.

In an eruption in the year 1693, the city of Catania was overturned in a moment, and 18,000 people perished in the ruins. The crater of Etna is a quarter of a mile high, on a plain three miles across. It falls in about every 100 years. The mouth is a mile in diameter, and shelves as an inverted cone, lined with salts and sulphur. The central fiery gulf varies in size; and noises arise from it with volumes of smoke. D'Orville descended by ropes near to the gulf, but was annoyed by flame, and sulphureous effluvia.

140 millions of cubic yards of lava were ejected from Etna in 1699. The main cone is 90 miles round, or 30 diameter, formed of a succession of envelopes of lava. It has above 80 minor cones, a secondary one of which was thrown up 165 years ago. Lyall thinks, that as each is the remnant of a great eruption, so their formation must have occupied full 12,000 years, to be added to the history of the previous volcano; and yet, in that time, he says, *no waves* could have reached them, without destroying heaps of sand and loose scoriæ. He infers the same, in regard to the cones in Auvergne, much older than the historic period.

The contemporary Roman writers are silent about the destruction of Herculaneum and Pompeii; but Dion Cassius, 150 years after, mentions it, and states, that giants issued from the earth, accompanied by sounds of trumpets, &c.!!

Vesuvius reposed for 1492 years, till 1631: and its crater, 1000 paces deep, and a mile and a half in diameter, was rich in wood, and herbage for cattle; but, since then, every ten years has had its destructive eruption. It is now 800 feet lower, and its crater three-quarters of a mile over, and from 1 to 2000 feet deep. The lavas are augite and felspar, with variety of minerals.

Pompeii was destroyed by showers of ashes, but Herculaneum by hot mud, on which six streams of lava have since accumulated. They had recently been destroyed by an earthquake, and were rebuilding. In the barracks at Pompeii were found the skeletons of two soldiers fastened by chains; and in the vaults of a country-house were 17 persons, among which was a perfect cast of a woman, and a child in her arms; the bones, with a gold chain and rings only remaining. Fishing-nets are abundant in both cities. A loaf, and various condiments, were found, and boxes of pills, &c. at an apothecary's. The Papyrii of Pompeii are illegible; but those at Herculaneum, though charred, may be decyphered. Other Papyrii have been found at Stabiæ, but illegible. Torre del Greco was covered with a solid rock of lava in 1794.

There have been twenty-nine destructive earthquakes in Calabria since 1602, occasioned, as is believed, by the materials of a pent-up volcano, the vapours of which pass through the soil in fissures, cracks, and chasms. Animals, buried under the ruins in the earthquake of 1793, were taken out alive after 30 or 40 days, and human beings survived after being buried 12 or 16. Fissures in the ground, radiating like a broken pane of glass, were from 30 to 200 feet deep.

A new Island, called Carrao, was thrown up by a sub-marine volcano, in July 1831, in the disturbed seas of Sicily. It was preceded by local earthquakes and terrific noises, many days before. It was in lat 37° 11′, and east lon. 12° 41′. The sulphureous smell was suffocating, and the vapour and ashes ascended 1000 feet with lightning. In parts it was 2 or 300 feet high, and about two miles round. The substance was various ashes, but no lava or pumice-stone. It has since disappeared.

In 1783, Hecla, in Iceland, ejected two streams of lava, 40 or 50 miles long, 7 to 13 broad, and 100 to 600 feet deep, which destroyed 9000 persons and 20 villages.

In Java, there are apertures in the ground which throw up mud in spherical masses, and have changed the face of their vicinity.

Some writers describe a volcanic band in the eastern islands, from 60 to 200 miles broad, extending in a segment of a circle, from the

Northern Philippines to Ceram and Timor, and thence through Java and Sumatra.

Another such band is alleged to extend from Poros and Hydra to Santorin, in the Grecian Archipelago. And the vicinity of the Azores is supposed to be the seat of much volcanic agency; which convulses those seas, throws up islands, &c.

From April to July, 1815, Tomboro, in Sumbawa, continued in violent eruption. The explosions were heard 980 and 720 miles, and only 26 of 12,000 inhabitants survived. The ashes darkened the air for 300 miles round.

In 1759, the mountain Jorillo, in Mexico, was thrown up from a plain 1600 feet high, and numerous cones from 3 to 600 feet, on a space of four square miles in one night. In 1819, Jorillo threw ashes 140 miles.

At Turbaco, in Mexico, on an extended plain, are about 20 cones, 20 or 30 feet high, with craters filled with water, through which azote and mud explode 100 times an hour.

The Sandwich islands are volcanic, and Owyhee itself is the cone of a volcano as high as Mont Blanc.

In 1822, 23, and 35, Chili was visited by a continued series of earthquakes, which continued daily for months.

In 1687, the sea retired from the shores of Peru, and returned in mountainous waves, which destroyed every thing on the coast; among other places Callao. In 1746, the same phenomenon again took place, and only 200 out of 4000 inhabitants of Callao saved themselves; nineteen vessels were sunk, and four, including a frigate, were carried over Callao into the country.

The most frightful volcanoes and fiery eruptions often take place in Japan, and in the northern parts of China.

The entire line of the Andes from Mexico to Chili, and the branches to Cumana, are volcanic, and subject to earthquakes.

In Syria there have been no volcanoes since the formation of the Dead Sea, but History records 100 earthquakes at Aleppo, Damascus, Antioch, &c.

By the earthquake of 526, 250,000 persons perished in Antioch, and in the ancient Berytus, all its inhabitants were destroyed. In 1822, Aleppo, &c. were overthrown in six seconds, and 30,000 persons perished.

The series of shocks which destroyed Lisbon, and great part of Portugal, lasted but six minutes, on an otherwise fine morning, on November 1, 1755. The Douro and Guadiana opened, and let out gases, and the quay of Lisbon, with 30,000 people on it, sank into an abyss, and not one body arose. The sea rose 20 feet so far off as Carlisle Bay, Barbadoes, and was of a dark colour. A wave, 60 feet high, passed over part of Cadiz. Kinsale was flooded, and at Funchal the sea rose 20 feet. The Lakes of Switzerland, Scotland, and Canada, were agitated. Bristol Hot-wells became red. A well in King's Wood became black, and the Avon flowed back while rising. It also affected wells and lakes in Scotland, and produced grating noises in English mines.

The houses which were engulfed at Port Royal, in 1692, were distinctly visible, in 1780, to persons who passed over them in boats. The Greeks used to allege, ages after, that the two cities of Bura and Helica were visible in the sea. The Welsh assert that the sea-wall, built to protect their coast, might be seen across Cardigan Bay 1000 years after. The natives of Syria affirm, to all travellers, that Sodom and Gomorrah may still be discerned in the Dead Sea.

Calicut was overwhelmed by the sea, and its ruins are still visible under it.

In March 1812, 12,000 persons were killed by an earthquake in the city of Carraccas only.

Fourteen earthquakes, in different parts of the globe, were recorded in 1827, and perhaps this is the average number.

The noise which immediately precedes a great earthquake is astounding. Some compare it to the loudest echoes of thunder, others to a subterranean torrent of rocks and stones, which stuns the victims, and frequently deprives them of sense.

Tucuman, in different parts, is visited by dull subterranean noises, often among rocks as loud as cannon. In Lima, the same noises resemble the rattling of coach-wheels over paved roads. Lightning kills the fish of rivers, an effect ascribed also to subterraneous agitations.

Explosions, like cannon, are often heard in mountainous districts, and they appear to arise from pyritical ejections at some depth. These merit more attention, for they seem to point to the origin of atmospheric meteors.

Light spots, like flame, are seen on the tops of mountains, which may arise from ascending phosphuretted hydrogen.

The *Allemaine Zeitung* relates that, in August, a subterranean fire burnt the roots of 250 acres of forest-trees, at Magland, in Switzerland, which, on falling, were also consumed; flames also, issued near Lausanne.

Cader Idris and High-stile have basins like remains of craters.

A remarkable volcanic explosion took place Jan. 20 to 25, 1835, at *Cosiguina* in Nicaragua. A total darkness took place at Leon, and showers of lava covered the country, and through Grenada the darkness lasted 40 hours. There were also successive earthquakes, and two islands were formed of pumice and mineral earth. Some farms were destroyed, a vessel was sunk, and the crew of another was involved in ashes 50 miles from Acapulca, and others over a space of 50 miles. The reports were heard and ashes fell at Kingston, in Jamaica, 800 miles distant.—*Galindo.*

The accounts of the uplifting of the coast of Chili, by earthquakes in 1822, was a mistake. Rivero, a scientific journalist on the spot, utterly denies it. Of course, however, a retreat of the sea has the same appearance as the rise of the land, and it appears that this is common all round, even to the river Plata, where there have been no earthquakes. The cause appears to be, that when the perihelion passed into South de-

clination, it carried an overflow of waters, which stood unduly high till the perihelion past the Tropic 600 years, since when its long tropical parallelism had operated for 2000 years, and within 600 years it has been retreating northward, and taking a lower level, as appears in the coral cliffs of New Holland, South America, &c.

An earthquake in Chili, Feb. 1835, extended 500 miles North and South, and was felt 300 miles at sea. At Talcahuano the sea retired, and then returned with a bore, destroying every thing. The earth opened and closed, vomiting steam and smoke. There was also a marine volcano The land rises or the sea retires, so that recent marine shells are found 600 yards above the sea.

Parish thinks, that recent shells at great elevations on the West coasts of South America arise from great earthquake-waves. In the middle of the 16th century, the sea suddenly rose and flowed some leagues over the land, leaving ships far inland. In 1586, the same occurred near Lima to the extent of 2 leagues. In 1605, Arica, and in 1687, Callao, &c. were destroyed in like manner, and ships carried by the sea's retiring, and then returning in mountainous waves, a league over the country. Wafer saw 3 vessels which had been carried in this way 5 or 6 leagues over the land. In 1746, an official account mentions the loss of 23 ships at Callao, some of which were carried over the city inland, and all the inhabitants of Callao, 5000, destroyed; and similar circumstances occurred along the whole coast. In 1751, Conception, in Chili, was destroyed in like manner, the sea retreating and then returning in mountains; and the same phenomena also took place at Juan Fernandez. In 1835, the whole coast of Chili was visited by the same calamity in three overwhelming waves. On such occasions, ships at sea receive violent shocks, and the sea becomes turbid with rising sand.

In 1815, Holworth Cliff, near Weymouth, smoked and inflamed spontaneously. It began by the sinking of 2 acres 30 feet, which for 3 years slid 800 feet towards the sea. It contained bitumen and pyrites, with alumine, limestone, and various shells. In 1826, vapour rose from the summit, and soon after smoke 20 feet high. On digging at the spot a body of flame appeared, and the whole to the depth of 6 feet resembled a lime-kiln with a strong sulphureous smell Workmen scattered the materials, but under different circumstances, it was an incipient volcano and points to their origin.

Near Baku, in Persia, in some parts of Italy, and in an island in the Levant, there are natural orifices in the earth, through which inflammable gas passes. Sometimes it takes fire by its own friction, on coming into contact with the oxygen of the atmosphere, and at other times requires to be lighted, like a gas-lamp. Similar gas constantly issues from the veins of coal-mines and produces fatal explosions; but it might be lighted and consumed as it is generated.

Superstition always attaches supernatural agency to this natural production of certain minerals. One of them, in the Levant, to this day, is called the burning-bush of Moses; and, at Baku, temples for fire-worship are erected over them; and one of them, the priests or devotees allege, has been burning for several thousand years, and will continue as a miracle till the end of the world. They call it everlasting fire.

Hanway relates, that the flame makes the soil hot, without consuming it, and if made to pass through a cane, or cone of paper, does not consume them, as described by Moses, though the flame will boil a pot. The ground is dry and stony, and smells like sulphur, and, if uncovered, the flame spreads to any distance. Brimstone is dug as an article of commerce, and naphtha-springs arise, and frequently in jets two or three feet high, which, on drying, become black, like pitch. In Persia, they burn it in their lamps and for cooking; and in Russia use it as a medicine.

The same sort of combustible exhalations arise in China, and that industrious people use them for purposes of manufacture.

A smoking spring in cold weather, is evidence of subterraneous heat in the depths whence it proceeds.

Lake Avernus used to kill birds that flew over it; Lake Quilotoa, near Quito, does so at this day; and the vapours of this, and of Lancerote, one of the Canaries, kill cattl also. All are on volcanic ground.

When hot-springs and minerals are found distant from volcanoes, the strata are much disturbed as though there had been volcanoes or other disturbance.

Two lbs. of half-melted basalt raise 7lbs. of water from 11 R. to 59 R., whence it is concluded that mountains of heated basalt may maintain the heat of hot springs for many centuries, as at Bath, &c.

It is impracticable to follow the 200 volcanoes more or less in similar action, or the 14 or 20 annual earthquakes with their various devastations, but those described are examples of all.

Of Mountains.

Mountains are the nodes or projections of the granitic nucleus, the transition or secondary formations. In general, later formations have been laid against them, by tides and currents of the sea, at various angles. The notion that they have been upheavings would be too ridiculous to mention, though adopted by many grave authorities.

Granitic mountains are rugged and precipitous, gneiss less so, and slate smooth and round. The European and Asiatic mountains are crowned with granite; but the Andes are topped with whinstone, or the newest floetz trap: and granite does not rise higher that 8 or 10,000 feet. Chimborazo has porphyry at its summit, and Pichincha basalt. Limestone is also found at great elevations.

The Soudah, or Black Mountains, in Africa, are of basalt, 1500 feet high, 100

miles wide, from north to south, and many hundred long.

Most mountains present their precipitous faces to the sea, and their slopes to the land.

Mountains are the chief objects of geological study, because their structure is obvious to sight, and their masses are penetrable by miners in search of the ores of metals. They are composed of strata, horizontal, oblique or vertical, either crystalline in granite, or with crystals embedded as in porphyry. These crystalline rocks having no organic remains, and always lying beneath strata, which abound in remains, are deemed older than the others, and called *primitive rocks* or strata.

The mountains subtract no more from the general rotundity of the earth, than the roughness on the coat of an orange.—We have no ridge above three miles, and only five or six mountains of four miles.

The first is $\frac{7900}{3}$ = the 2633d, and the second $\frac{7900}{4}$ = the 1975th the diameter. Now an orange, 4 inches in diameter, has spiculæ the 100th of an inch, which are the 400th.

There are 120 mountains or ridges above 10,000 feet above the level of the sea, and 150 from 5000 to 10,000, many of them extensive ridges. The chief are as under, by Riddel's scale:

Race-course, Brighton	*feet* 400
Monmouth Hill	450
Arthur's Seat	800
Dunsinnan	1030
Edgecombe	1300
Rumbles Moor	1331
Malvern	1350
Wrekin	1450
Penmaenmawr	1460
Gibraltar	1470
Pentland	1600
Boulsworth	1708
Pendle	1839
Three Brethren	2000
Ingleborough	2384
Sion	2100
Vaucluse	2150
Whernside	2426
Cheviot	2670
Sinai	3000
Saddleback	3080
Schehallien, Skiddaw, and Ben Lomond	3280
Montserrat, Athos, and Heartfell	3300
Helvellyn	3350
Snowdon, Table at Cape	3500
Stromboli	3850
Vesuvius	3900
Parnassus	3950
Ben Lawers	4030
Ben Nevis	4400
Soufriere	4830
Hecla	4900
Puy de Dome *(one mile)*	5200
Feugari	5248
Pelion	5310
Port des François	5760
Col de Tende	6100
Pirnari	6143
Pierus	*feet* 616.
Ossa	6107
Stony Mountains	6450
Cenis	6800
Rouge	76·0
Santa Fé	8700
Pilate	8950
St. Gothard	9080
Carnigou, Pic du Midi	9300
Olympus	9754
Parmesan	10090
Buet	10120
Pic Blanc *(two miles)*	10400
Etna	10950
Perdu	11200
Granada	11250
Hochhorn	11300
Simplon	11542
Egmont	11440
Atlas and New Zealand	12000
Argentiere	12180
Teneriffe	12250
St. Elias	12700
Iseran	13272
Ophir	13950
Finster-Aar-Horn	14111
Ortel	14400
Cervin	14837
Long's Peak, R. M.	15000
Southern Thule	15100
Dome de Gonté	15500
Rosa	15550
Pichincha	15600
Mowna Roas Owhyhee	15700
Mont Blanc	15732
Tartarian, or Altai *(three miles)*	15900
Cotocache	16450
El Altar and Hinica	17500
Cotopaxi	18900
Disis Casada and four others	19500
Chipki, Himalayas	20597
Ruldung	21103
Chimborazo	21000
Purgeool, Himalayas	22488
Aconcagua, South America	23200
Nevados	24200
2d Peak	24450
Sorato, South America	25000
14th Peak of the Himalayas	25400

American travellers and observers elevate the rocky mountains to a level with the Andes, and even the highest of the Himalayas.

The greatest elevations are in the torrid zone, and are from 20 to 25,000 feet; those in the temperate zone are from 12 to 16,000; and those in the frigid only from 5 to 6000.

The elevation of perpetual snow varies with the heat of the surface Near the equator it is 15,700 feet; within the tropics 15,000; in the temperate zone 8600; and in Norway from 4500 to 5000.

The fertile plains of Quito are 9500 above the level of the sea. The town of Riobamba is 10,700 feet; and the city of Mexico enjoys a fine climate at 7500 feet; while in Europe, &c. the hardiest pines grow only at that elevation; and, in the frigid zone, only at the height of 500 feet.

The highest inhabited place on the globe is the Port-House of Ancomarco, in Peru,

at nearly 16,000 feet above the sea-level. The Indian village of Tacona is 14,800 feet, and the towns of Calamarca, Puno, and Oruro are each about 13,000 feet.

Quito is 9800 feet, and Santa-Fé de Bogota is 8880 feet. Mexico is 7400, and the hospital of St. Gothard but 6700 feet. Briançon is 4300 feet, and Barege, in the Pyrenees, 4200. Madrid is 2000 feet, Munich 1740, Lausanne 16?5, and Geneva 1200; Vienna, Gottingen, and Toulouse have the same elevation, 440 feet. Paris is but 220 feet, and Berlin but 132 feet.

The *Himalayas*, or seats of snow, are the termination of the elevated plains or steppes of Tartary. Their extent, from the sources of the Ganges to those of the Baramapootra, is 1400 miles, and their descent to the sea is that of the rivers and plains of Hindostan. The mountain ridges are from 50 to 60 miles wide. They run from N. W. to S. E., and are the source of all the rivers of the oriental seas, and the materials of the plains.

Gerard measured his elevation at the pass of Brooang, in the Himalayas, with a barometer, and found, at 15,000 feet, the blue-bell in full flower, and many other flowers of the temperate zone.

Captain Webb, by the barometer, at the Temple of Keder-nath, about lat. 30, determined the height to be 12,000 feet above the sea, or 11,897 above Calcutta. The highest ridge of Nittee Ghaut he found to be 16,814 feet; and the Temple of Milem 11,790. These places had no snow, but were surrounded with wheat and barley, forests of oak, pine, &c. with luxuriant vegetation, and the fleeces of Cashmere.

The barometer determines Chipki to be 20,597 feet; and Trigonometry determines Purgeool to be 22,488, and Ruldung 21,103 feet. At 15,500 feet, beds of fossil-shells are found. At 20,000 feet, there is no perpetual snow.

The Altai Mountains are 4000 miles in length in Siberian Tartary, and often as high as the Alps.

The Andes chain is 4600 miles long, from the Straits of Magellan to the Gulf of Darien, at about 100 miles from the shores of the Pacific, and of an average heighth of 1½ miles from the level of the sea. In truth, the same chain runs through Mexico to the Rocky Mountains of North America, and the Alleganies in New England. They are a sort of buttress, against which the whole American Continent leans, and are the nucleus of its formations, by the washing of the hills, and the working of the ocean. They are chiefly composed of clay-slate, on which lie lime-stone and iron sand-stone, while the loftiest are newest porphyry, with little visible granite. The clay-slate is supposed to be volcanic, as volcanoes are numerous, and they exude mud and clay.

Coal is found near Huanco, at 14,700 feet. Fossil shells and sand stone appear at 14,120 feet near Huanca Velica. Basalt, at Pinchinca, is 15,500 feet. But granite is not found above 11,500 feet, and is unknown in Peru. Porphyry forms masses of 10 or 12,000 feet in depth, with horn-blende. Sand-stone, near Cuenga, is 5000 feet thick; and a mass of pure quartz, near Caramarca, is 9600 feet perpendicular.

From Cotopaxi southward 40 volcanoes are constantly spreading destruction, and covering tracts with clay, sulphur, and metals.

A ridge of the Andes, from 10,000 to 17,000 feet high, lies between the Chilias and the Argentine Republic. There are several passes. Minor ridges, from 2500 to 1200 feet, lie between the Andes and the Pacific. Many rivers run from them to the sea, as the Biobio, Itata, Maypu, &c. as large.

The chains of South America unite near Panama, lower towards Mexico, and then expand into elevated table-land, 6 to 9000 feet high, with volcanic mountains; and terminate at 3000 feet, in California.

The mountains in North America are in heighth as under:—

Long's Peak, Rocky Mountains ...	15000
Mount Washington, N. Hamps.	6234
Mansfield Mountain, Vermont	4279
Catskill Mountains, New York.......	3800
Black Hills of Missouri	3500
Alleghany, in Virginia	3100
Lakes Winnepec and Superior......	1200
Head of the Mississippi	1280

The European mountains consist of primitive and transition rocks.

The European mountains are considered as seven groupes, the Peninsular, Alpine, Grecian, Tauric, Sarmatic, British, and Scandinavian.

Altogether the Alps consist of about 180 mountains, from 4000 to 15,000 feet high. Below 1000 feet, oranges, olives, and figs flourish, and to 1600 the vine. The chesnut to 2800, the oak to 3800, and the pine to 6500. Heaths and furze to 8700 and 9700.

St. Veran, in the Cottian Alps, 6693 feet, is the highest inhabited place in Europe. The Post-House on Mount Cenis is 6453. The road-pass of the Simplon is 6578, of Mount Cenis 6775 feet; of Chilavenna, Scaletta, and Julier, in the Rhœtian Alps, are 8780, 8582, and 8134. Tauern pass is 9893.

The passes in the Pyrenees are from 6000 to 9800 feet.

The road-pass of St. Gothard is 6808, of St. Bernard 7115, and of the Splusen, 6814. The road-pass of the Bocchetta is 2550, and the Aquila-pass is 4570.

There are five passes over the Himalayas, some of which are 15,000 feet.

No Spanish mountains rise above 12,000 feet, but of 10,000 to 12,000 there are in the Peninsula, including the Pyrenees, 23. Pic de Neton is 11,424. Veleta 11,385, Vignemale 11,001, Posets 11,277, Perdu 11,168, and Peneranda 11,031.

The Cevennes groupe consist of about 25 mountains, from 5 to 6000 feet. The Vosges contain 5 above 4000 feet, and 6 others above 3000. Gueboiler, the highest, 4695.

The Jura approaches the Alps, Reculet is 5633 feet, Tendre 5543, Columbier 5496, Dole 5513, and Chasserale 5282; 39 others from 3 to 5000 feet.

In European Turkey, Scardus and Sco-

mius, in the Balkan or Hæmus groupe, are 10.000 and 9000 feet.

The highest in the Grecian chain are in Albania, and there are 4 from 7500 to 9000 feet. Chimœra is 5000, Parnassus 5750, Helicon 4500, Olympus 9000, Ossa 6400, Pelion, Œta, and Tagetus 5115, Othrys 6400, Pentelicus 3500, and Hymettus 3000. Pseloretti, in Candia, 7674, and the highest in Cephalonia 5368.

Etna, in Sicily, is 10,871, the Pizzo di Case 6509, and Mofera 6247.

The Appennines, from north to south, contain Corno 9521 feet, and Amaro 9131, besides Velino and Vetora 8150. Three others, Cimone, Sibella, and Terminillo, are about 7000. 10 or 12 other points are from 3 to 6000. Vesuvius is 3740, Caloo 5295.

The mean inclination of the Peak of Teneriffe is 12½°, and of Mont Blanc 45°.

There are on mountains perpetual snow-levels, at the following heights.

On the Andes, lat. 2°	14,760 feet
Mexico, lat. 19°	13,800
Teneriffe	11,454
Etna	9,000
Caucasus	9,900
Pyrenees	8 400
Alps	8,220
Iceland	2,890
Lapland	3,100

On Chimborazo, the upper 5400 feet is perpetual snow. At 3500 metres high, from the level of the sea, woody plants disappear. Then shrubs only, then plants, then a wide expanse of grasses, then mosses, lichens, &c. on porphyritic rocks, then snow and ice.

On the elevated plains of Quito, and others to the South, the sites of towns and extensive industry, the barometer stands constantly at 20 inches.

The Peak of Teneriffe presents five zones of different vegetation. For 7 or 800 feet it produces vines, corn, olives, &c., the second zone produces myrtles and trees, the third chiefly pines, the fourth and fifth produce little vegetation, and is very cold: the upper part is covered with pumice-stones and lava. In the middle is a cone, and on the top of it a crater 300 feet long and 200 broad, and of such evident antiquity that Humboldt conceives it has not been in action for some thousand years.

The depths of fissures or crevices, between the Andes, are even more astonishing than their heights. Many of them descend below the level of the sea. At Chota, is one 5000 feet deep, and at Cutaco one 4200.

The Caucasian mountains lie between the Euxine and the Caspian. The story of Prometheus arose from the petroleum fires at Baku. They are from 3 to 400 miles long, and 200 broad, of granite and limestone.

The summit of Mont Blanc is a narrow ridge, like the roof of a house; its uppermost rocks consist of strata of granite, nearly vertical. De Saussure, at the top, on the 3d Aug. found Farenheit 27°, while at Geneva it was 82°; the barometer fell to 16·02, while at Geneva it was 27 2. The air contained six times less humidity than at Geneva. Respiration was difficult, and sounds feeble; while the pulse was double.

Mount Carmel, so often referred to in the Jewish histories, is the highest of several mountains in its vicinity, *i. e.* 2000 feet, with steep and barren sides.—There is a chapel upon it, and monks called Carmelites.

Mount Sinai is granite, and the adjacent Moussas or Horeb are sand-stone, in lat. 28½, on the Peninsula, between the gulfs of Suez and Akabah.

Seitzen, Gray, and Ehrenberg state, that a sand-hill on mount Sinai, called Nakato, by continually falling, produces remarkable tones, like an Æolian harp; and a murmuring noise, like a distant cannonade, and louder at certain times.

The two highest mountains in Ireland are Carral-Tual 3412, and Sneibh Dovin 3146; six others approach 3000 feet. The highest in Wicklow is 2302, and Kerry Paps 2280.

On the Brocken, the highest of the Hartz Mountains, a spectre is seen, when the sun, at a certain height, projects the shadow of the spectator on any clouds or mists in the atmosphere. His image is several hundred feet; and all his motions are displayed.

One of the most remarkable *precipices* is at Table Mountain, in South Carolina. It is 3000 feet high, and stands on the edge of a valley, which nearly doubles its perpendicular elevation. Near it is a cataract of 700 feet.

Mount Ararat is remarkable for its aspect, height, and traditions. It is 17,000 feet above the sea-level, and 10,000 feet above the table land on which it stands. Local traditions and superstitions affirm, that the ark of Noah or Xisuthrus rested here. All travellers agree, that it has been volcanic, and the cavity of its crater is still palpable; but this must have been in action before the age of Xisuthrus or Noah. Lava and pumice-stone abound on and around the mountain. Priests shew the spot where Noah settled, and planted the vine.

A mountainous chain extends from Cumberland to the Land's End, the source of the rivers and minerals. Cross Fell is 2,900 feet, Scaw Fell is 3160, and Helvellen and Skiddaw rather above 3000, the highest of the Cheviot is 2650. Cadir Idris is 2900, Plynlimmon 2460, and Snowdon, the highest, 3570, or ⅔ of a mile.

The Malvern Hills, in Worcestershire, commence a chain which extends through Derbyshire, separates Yorkshire and Lancashire, and continues to Scotland, where it forms one side of the valley of the Tweed and Clyde. North of that, valleys and mountains cover the ancient Pictish country, while other mountains characterize Wales, and set bounds to the Atlantic.

The Highlands comprize the country from the Clyde through Dumbartonshire, and thence by Dunkeld and Brechen to Aberdeen. Glenmore and the Caledonian Canal from Inverness to Fort William, divides them into 2 parts. The Grampian chain includes Ben Lawers 3915 feet, Benmore 3870, Schihallion 3550, Macdul 4327, Cairngorm 4095,

Cairntoul 4225, Ben Avon 3967, besides others above 3000 feet. All of bare granite and desolate. Ben Nevis 4370 feet, is near Fort William, (800 higher than Snowdon) and 24 miles round. It has a precipice of 1500 feet, and is always covered with ice and snow. There is also another range from 3 to 4000 feet north of the Caledonian Canal. Altogether, there are 45 mountains north of the Tweed above 2000 feet.

GEOGRAPHY.

[As the subjects of Geography are classed under various heads, and the common places are found in Goldsmith's and other Elementary School-Books, this article will contain some Tables of primary use, embracing, in brief, every object of enquiry, and some minor data from modern travellers.]

The Globe of the Earth is subject to periodical and gradual changes. We know only its surface, less in proportion than the skin of a plum. The waters librate from hemisphere to hemisphere with the perihelion, and they librate with the Earth's librations, or scolloped or wavy terro-lunar orbit, producing tidal changes. The Equator, too, has a motion in latitude, owing to the annual increase in the orbit taking place on the contrary side of the last Equator. Other causes of change are the pressure of the surface towards the centre, chemical combinations facilitated by internal heat, and finally, those explosions in volcanoes, which form new strata of molten substances. Then electrical action, always exerted between different strata, generates metals and crystals; and finally, the evolution and decay of temporary organizations.

The superfices of the whole globe, sea and land, is in square feet, log. 15·738510; in square miles 196,441,000; and in square degrees 41,165.

About three-fifths of the surface is sea, or water; and of the two-fifths which rise above the sea-level, after deducting the frozen and northern regions, the sandy deserts, the mountains, and the outcrops of sterile rocks, not more than one-third of the two-fifths, or 0·1333, are adapted to subsistence.

Norwood, in 1635, determined a degree in England to 69·545 miles; Cassini, in France, in 1718, 69·119. The three observers in Peru, in 1744, 68·732; Mudge, in England, in 1802, 69·146; Maupertuis and Swanberg, in Lapland, 69·402 and 69·292; Lambton, in India, 68·743; and Biot, in France, 68·769. Hence the mean appears about 69 miles.

The mean degree on the Meridian is now taken at 361547·1 feet, or 69·08067 miles.

In England, Colonel Mudge determined 2·8398 degrees to be equal to 1,036,337 feet, which is 364,933 feet to a degree.

Lambton determined a degree at the equator to be 121770 34 yards; the square diameter to be 13945831·6 yards, the polar diameter 13900884, and the circumference 43812148 yards, or 24893 266 miles.

The length of the Meridian, from the Pole to the Equator, was determined, in 1799, by the Commission of the Institute, to be 5,130,740 toises, and the 10 millionth, or metre, to be 0·5130741th of a toise. That is, 6217·857 miles for 90°; or, 69·0873 miles, or 364729 9 feet to a degree.

Kater makes the major radius of the Earth 3692·439 miles, and the minor 3929·2577; the compression 300. Gauss makes them 3271852·32 toises, and 3260853 toises and the mean degree 57008 65 toises, or 364517·1 feet (6 39459 feet to the toise). The compression 1—297 479th.

The mean of five celebrated modern determinations of a degree of the equator is 60,858 fathoms, or 365,154 feet, which, 360, reduced to miles, are 24,897 miles for the equatorial circumference, or 7924·9272 for the diameter, which is 69·158, or 69 1-6th nearly to a degree. Then the polar diameter is about 25 miles less.

Airy and Ivory make the equatorial diameter 7925·648 miles, and the polar 7899·17 miles; difference, 26·478 miles. The ratio 299 to 298 nearly.

Taking the equatorial diameter at 310, and the Polar diameter at 309, which is the mean of 9 or 10 determinations, the difference of the two is 25 56 miles.

The square degree in statute miles is, to that in square geographical miles, as 4 to 3 nearly.

Then a *marine* league, of 20 to a degree, is 6085 25 yards, or 3·45753 Eng. miles.

The obliquity of the Earth's axis is 23° 27′ 37″ nearly, in 1839.

The Nautical Almanac made the mean obliquity, in 1835, 23° 27′ 39″ 6, or per Bessel 23° 27′ 39″·26, being 9″ 94 seconds in 19 years, or 52″·316. In 750 B. C., the Chinese made the obliquity 24°, which, if to be relied on, gives a diminution of 74″ per century. In 330 B. C., Pythias made it 23° 50′, *i. e.* 62″ 5 per century. And, in 150 B. C., Hipparchus made it 23° 51′ 20″, or 71″ per century; the mean of the 3 being 69″. Taking it at 46″ now, it seems to be a diminishing quantity.

The cause of the diminution of the obliquity of the ecliptic is the decay of mountain masses, and the diffusion of land by the sediment of rivers. Unequal structure was the first cause of obliquity, and the revolution and rotation were determined by the *mean centre* of the mass.

The Sun's declination, or the declination of the fifteenth degree of the 12 signs, is as under:—

	deg.	min.	sec.
♈ ♍ ♎ ♓	5	15	2
♉ ♌ ♏ ♒	16	21	26·6
♊ ♋ ♐ ♑	22	37	32·9

The solar day is to the sidereal as 1 to 0·997269.

A star passes the meridian every day 3′ 55″·9095 sooner than the preceding day, owing to the intervening motion of the Earth in its orbit. A minute of time, or 60 seconds, gives an increase of 0″·164, and an hour 9′·857. A second of time gives an in-

crease of 0·003. The Log. for converting sidereal into mean solar time is 9·998813.

The length of the day, in latitude 49, 51, 53, and 55, for the 3 above declinations, is as under:—

	hrs. ′	hrs. ′	hrs. ′
Lat. 49 ..	12 54	14 45	15 58
51 ..	12 56	14 58	16 6
53 ..	13 3	15 10	16 40
54 ..	13 8	15 27	17 4

The angle of 23° 27′ 40″ made by the ecliptic with the Equator, determines all the zones and circles on the globe. Thus, the *tropics* are 23° 27′ on each side the Equator; and the polar *arctic* and *antarctic* circles are 23° 27′ from the north and south poles. The middle regions 90°—46° 54′, or 43° 6′ are the two *temperate* zones.

The *solstitial* points are the first degrees of Cancer and Capricorn; and the *equinoctial* points are the first of Aries and Libra.

	d.	h.	′	″
From Capricorn to Aries the Sun passes in -	89	1	20	52
From Aries to Cancer -	92	21	13	59
From Cancer to Libra -	93	13	54	21
From Libra to Capricorn -	89	17	21	19
From Aries to Libra, N. -	186	11	8	20
From Libra to Aries, S -	178	18	42	41

The Earth is in directly opposite signs.

The tropical year, in 1837, was 365d. 5 51′ 1″, and the mean is 365d. 5 48′ 48″.

The daily motion of the Earth, on Dec. 31, in perihelion is 61′ 10″, and on July 1, in aphelion, 57′ 11″. The semi-diameter of the Sun in the first 16′ 17″76, and in the second 15′ 45″53. The mean distance is on April 1 and Oct. 2.

At London, on Jan. 1, the day is 7h. 50′; Feb. 1, 9 h. 4′; March 1, 10 h. 52′. April 1, 12 h. 51′; May 1, 14 h 48′; June 1, 16 h. 14′; June 21, 16 h. 34′; July 1, 16 h. 30′; Aug. 1, 15 h. 22′; Sept. 1, 13 h 30′; Oct. 1, 11 h. 34′; Nov. 1, 9 h. 34′; Dec. 1, 8 h. 6′; Dec. 21, 7 h. 44′.

The ratio of the two primary forces, that of the orbit motion 49923 feet to the rotatory surface of the sphere 6102 6, may be taken as the standard of terrestrial *dead weight*, for it is the same, 1 to 16, for all times.—*See* ASTRONOMY.

In every passing hour we are moved in the Earth's orbit 66,092 miles, and by the rotation 1037 miles. These changes are our time, and the life for its fleeting existence of every thing terrestrial.

The eccentricity of the Earth's orbit diminishes about 40 miles annually, and, at the same rate, in about 40,000 years, the orbit would be a circle.

The greatest southern declination of the perihelion was in 1250, A.D.

A degree of latitude lengthens from the equator to the poles, owing to the polar diameter, 7900, being 25 miles shorter than the equatorial, 7925; by which the surface flattens as it is more distant from the equator, and we therefore go farther to raise the celestial pole a degree, or ninetieth

The pendulum is our best standard for determining the motions of the Earth during one of its consecutive motions, resulting from the Earth's two motions.

The length of the second's pendulum is directly as the orbit velocity, and inversely as the perp. deflection by the cube of 3·1416. *i. e.* $\frac{O}{3{\cdot}1416^3 \times P.} = L.$

In connection with the pendulum, the orbit velocity for a second is the product of its mean length in feet, into the perpendicular deflection into the cube of 3·14159; $O = L.\ P.\ 3\,1416^3$. (The perpendicular deflection is the rotation at the equator divided by 1 57079.)

The relative force of weight, in different parts of the Earth, is directly as the square of the actual sine and cosine of the spheroid, at the place; and inversely as the square of the radius as to the place and equator. As to any other place, it is inversely as the square of the sine and cos. of that place.

The centre of oscillation of a pendulum, and the centre of suspension, are reciprocal and interchangeable.—*Kater*.

Vibrations for 24 hours are determined by vibrations for 8 minutes, within half a second, for the 24 hours.—*Kater*.

10,000 lbs. at the Equator would weigh 10,031 at London, since the same pendulum, which vibrates 86,400 in a day at the Equator, vibrates 86,535 in lat. 51·32, and the effect is as their squares. It arises from the square of the sines and cosines becoming less as we approach the poles, than the square of the radius of the Equator.

Of Latitude and Longitude.

At London (51° 32′,) a degree of longitude is exactly 42755 miles east or west, or four minutes of time sooner or later. Thus, at Wallingford, westward, time is later, or it wants four minutes of twelve there, when it is noon at London; and at Kelvedon, eastward, time, or the sun, is sooner, and when twelve there, it wants four minutes of twelve in London. The earth turns from west to east, and hence the sun and stars *appear* to move from east to west.

So Bristol, in 2° 35′ 29″ west, has its noon and time after London, and the difference is to be subtracted from London time. The 2° is 8 minutes, 30′ is 2 minutes, and the odd 5 29 is 21 seconds; therefore Bristol is 10 minutes, 21 seconds behind London time, and when 9 o'clock in London, it wants 10½ minutes of 9 at Bristol. So with all other longitudes in the Table.

The Moon is the best measure, because she moves from 12 to 13 degrees every 24 hours, a space equal to her own diameter every hour, and in 2 minutes of time a minute of a degree. Then, as the Nautical Almanac gives the Moon's place at Greenwich every 3 hours, and also the distances from the Sun and 9 or 10 Stars, nothing is more easy than to observe the same with a sextant, and from knowing the true time at the place, we estimate the Longitude by the difference of time at the rate of 1 degree to

every 4 minutes of time. The same is also done by occultations; by Jupiter's satellites; by Eclipses; and by perfect chronometers.

Latitude is determined either by the heighth of the Polar Star and Alioth near it, or by the meridian heighth of the Sun, the declination being allowed for. Or, it may be found by 2 altitudes of the same Star.

To find the Latitude from the observed altitude of any Star:—1. Add the tangent of the Star's polar distance to the cosine of the Star's distance from the meridian for the tangent of an angle (A). 2 Add the cosine of A, the secant of the polar distance and the sine of the corrected altitude. Reject 20 from the logarithmic index, and then, if the Star is above 6 hours from the meridian, the sum of A and B is the sine of the Latitude; if less than 6 hours, the difference of A and B is the Latitude. 3. When the Star does not pass between the zenith of the place of observation and the elevated pole, the complement of their sum must be taken, and this complement is the Latitude of the place.

Navigation is the art of directing a course, or ascertaining a position, (when there are no land-marks,) by means of objects external to the Earth, as the Stars, &c. The *latitude* of a ship is determined from the heighth of the Sun, taken by a quadrant at any hour of any known day, or from a meridian altitude, by a simple addition or subtraction. And the *longitude* is determined by measuring with a quadrant the exact distance of the Moon from certain Stars at a known moment. Then the same distance is exactly calculated in the *Nautical Ephemeris* for different hours at Greenwich, and the difference of time, deduced from known lunar motion, and reduced to degrees, is the longitude.

The semi-diameter of the Earth is 20,922,100 feet, log. 7·320601. Then every addition in height is an addition to the secant, and the degree and minute in the tables (at 69 158 to a degree) is the visual distance, the proportion of the parts in the Trig. Rad. to the feet in Earth's Rad. being 47·8 to 1, Log. 2 679389. Then, if the height is 1000 feet, the secant is 20,923,100. Log. 7·320625, to which adding Log. of 478 = 2·679389, this gives 10·000014 of which the sec. by the tables is 21 min., which, as 60 to 69, is 24 miles visual distance at 1000 feet high.—If the height is a mile, or 5280 feet, then this, added to 20,992,100, gives Log. 7 320714, which + 2·679389 gives 10 000103 for the secant, corresponding to 73 min., or 83 miles visual distance. If the visual distance is given to find the height, work backward. Thus 100 miles equal 87 min., then the sec. is 10·000145 less 2·679389 = 7 320756 = 20929341, which is 7241 feet in the secant or height from which 100 miles may be seen.

If a body on a steel-yard preserve its balance at two distances from the centre, just as the Earth keeps its station at a 32d more or less, we should seek for the cause in some centrifugal force, when the body on the steel-yard was nearest; and this is the fact as to the Earth in perihelion. The increased mass and action of the waters are that centrifugal force with consequent increased velocity of motion, and the increase follows the perihelion through its declinations.

The oblate spheroidal figure of the Earth varies the ratio of the surface as 4 to 3·984466.

The point of impulse conferring rotation on the Earth is 25 miles from the centre.

The rotation of a Planet is the effect of an excess of the right, or tangential force in space over the deflective, or central force, which turns the Planet into an orbit at equal distances from the Solar fulcrum. The deflection is such as, with an equal force at 90°, would produce a right chord at 45°, but no *rotation*. Then the right force is such as converts the chord 1 4142 into an arc of a quadrant, as 1·5708, and at the same time turns one hemisphere around the inner.

The angle of oblique action of the right force, on the mass, is directed in accordance with the ratio of the chord 1·4142 to the arc 1·5708; that is, it is 45° for the radius, or central force, and 51° 45′ for the tangential, or right force; and this swells the radius 93,344,222 to the chord 131,925.757, and the chord to the arc of the quadrant 146,610,000 miles. Then, in proof, the 91·564 rotations into 24,875, the mean circumference is 2,284,073 miles, and the arc, divided by this, gives 64·338, which, by 4, is 16·0845, the mean central force arising from the *rotation* of the spheroid!

Satellites do not rotate, because they are as one with the primary, and the rotative movement is exhausted by the primary. In the case of the Earth and Moon, the entire orbit of the Moon is exactly equal to the Earth's ecliptic motion for one day, or one rotation; hence, the rotative force measures and causes the lunar orbit, and is exhausted on the Earth.

If the Earth only progressed in its orbit, the effect would be that dense bodies would move foremost, and the others form a dispersing train. If it only turned round in one spot, the greater velocity of the external parts would cause them to fly off in tangents, and thus produce dispersion in tangents. But the simultaneous action of a progressive and rotative motion has a neutralizing and consolidating effect.

The position of bodies on the Earth, in regard to the orbit direction, does not affect bodies as to their central force, since every part is perfectly governed by its opposite.

Eratosthenes, of Alexandria, under the patronage of the Ptolemies, was the father of geography. He taught the rotundity of the earth, and determined the longitude of 100 degrees, Cape St. Vincent, or the Sacred Cape of Iberia, calling China the *city* of Thinæ. His latitude extended from Sennaar to Germany, and Thule or Shetland, in all 44 degrees, beginning 12° north of the Equator; that is, 70,000 stadia of longitude and 38,000 of latitude, which, at 8 to a mile, would be 8750 miles, and 4750. Britannia was drawn as an obtuse triangle, whose base was the Channel, and Ireland opposite the northern angle.

The first recorded map was drawn by Aristagorus, of Miletus, about 480 B. C. Others imitated it; and some ancient philosophers transferred the degrees in the Heavens to the Earth, and guessed a terrestrial degree to be about 69½ miles as the 360th of the sphere.

Geography and all the sciences were stationery under the plundering Romans. Mela and Pliny were the only exceptions, and little new transpired.

Ptolemy, of Alexandria, did more in his single life than the Romans in 2000 years. He drew the lines of latitude and longitude in a globular form, but, in 1630, the pope still treated the earth as a plane. He called China, Serica, but assigned to it not greater extent than Spain.

The Jewish historians display utter ignorance of geography beyond 2, 3, or 400 miles from Jerusalem, and call all beyond the ends of the earth, which was regarded a plane.

The first voyage of discovery was that patronised by Necho, in which some Phœnicians left Egypt by the Red Sea, and in three years returned by the Straits of Gibraltar. The second was by Sataspes, who sailed to the parallel of the Cape Verd Islands. The third was that of Hanno, a Carthaginian, who reached Cape Palmas with a large fleet. The fourth, that of Eudoxus, who rounded Africa. The fifth, that of Pythias, who visited the British and North Seas. The voyage of Nearchus was a naval movement, from the Indus to the Persian Gulf. The Peryplus of the Erythrean Sea was the trading-voyage of Arrian, of Alexandria, who sailed to Malabar and to Mosambique.

The Arabians preserved what Ptolemy had effected, but monkish maps made Jerusalem the centre of the world!

The discovery of the West Indies, in 1492; of South America, in 1494; of North America, in 1497; of Hudson's Bay, in 1500; of Brazil, in 1501; of the South Sea, in 1513; followed by the voyage of Magellan *round the world* in 1520, were great eras in geography. The voyages of Anson, Byron, Wallis, Cooke, Vancouver, Flinders, La Perouse, and Bougainville, in the last age, perfected our general knowledge.

It was, however, a further step to determine that the earth was one of a system of planets, which created the four seasons by revolving round the sun; and it was not admitted till Bruno by his martyrdom, and Galileo by twenty years' proscription, sealed the doctrine. The last great truth is the still proscribed principle that weight and the fall of bodies are caused by the two-fold motions of the earth, as its means of aggregation, and 30 years' proscription of this fundamental truism, have not yet satisfied the pride of Schools and Royal Associations!

Epochs of Geographical Discovery.

871 Iceland.
950 Greenland.
1001 Winenland, by Icelanders, since called America.
1344 Madeira.
1345 Canaries
1364 Guinea.
1434 Cape Nun.
1440 Senegal.
1448 The Azores.
1449 Cape Verd Islands.
1484 Congo.
1486 Cape of Good Hope.
1492 The Bahamas, by Columbus.
1492-3 Cuba, Hispaniola, and Jamaica.
1497 Newfoundland.
1499 American Continent, by Amerigo.
1500 Brazil.
1502 Mexico.
—— St. Helena.
1506 Madagascar.
1511 Sumatra and Moluccas.
1512 Florida.
1513 Borneo and Java, and South Sea.
1515 Peru.
1516 Rio Janeiro.
1519 Straits of Magellan.
1521 Ladrones and Philippines.
1524 North America.
1525 New Holland.
1534 Canada.
1542 Japan.
1587 Davis' Strait.
1607 Hudson's Bay.
1616 Cape Horn, and Van Diemen's Land.
1673 Louisiana.
1690 Kamschatka.
1765 Otaheite, by Wallis.
1778 Sandwich Islands, by Cook.
1806 Phillips's Island, &c. by Turnbull
1819 Melville Island, by Parry.
1832 The Niger, by Landers.
1836 Boothia, by Ross.
1837 Northern America, by Simpson.

The torrid zone is 16·5 millions of square miles. Each temperate zone is 51·55 millions miles, and each frigid 34·66 millions. The whole, 199 millions nearly; the two temperate and the torrid being 120 millions.

The Polar Seas were explored by Barents as far as lat. 80° 11′; and Phipps, to lat. 80° 48′; but beyond this point they present an impassable barrier of ice. Parry ascended to 75°. A ship from Hamburgh, in 1817, professed to have reached the eastern coast of Greenland, and to have sailed along it to the 80th degree, though that coast had, for four centuries, been blocked up with fields of ice. Russian voyagers to the north of Siberia have yet been unable to pass Cape Vostochnoi. In the sea north of the American coast, Parry proceeded to long. 113° 46′ 43″.

Simpson and Dease, agents of the Hudson's Bay Company, have completed, in 1837, the survey of the North American coast to long. 156° 20′, or 4° beyond Cape Halkett in lat. 71° 23′ 30″, beyond which no impediment is opposed to the passage to Cooke's Inlet and Behring's Straits. They effected the object partly on foot and partly in an Esquimaux light skin-boat, other methods of navigation being impracticable!

The South Polar Sea has not been penetrated higher than 75°, and there it presents dangerous and impenetrable fields of

ice. Weddel, in 1825, sailed to 74° 15′ S. lat., long. 34·17, when he was obstructed.

The Portuguese appear to have discovered New Holland, &c. from Java, and called it Java Major. The Spaniards, from Lima, under Mendana, discovered the New Hebrides, and actually visited Otaheite in the 16th century, and called it Sagittaria. Van Diemen, a Dutch governor of Batavia, sent out 5 expeditions of discovery, and one under Tasman discovered Van Diemen's Land, New Zealand, &c.

Cooke, &c. rather completed and surveyed than discovered, but he determined that there is no Austral continent, and made many smaller discoveries.

Travelling itself has become a science: and, except the centre and N.E. of Asia, and the central parts of Africa and South America, every portion of the earth has, within half a century, been reported on by enlightened travellers.

Of 100 parts, into which the surface of the land may be divided:—

Europe contains	7
Africa	21
Continental Asia	33
New Holland, &c.	8
South America	15
North America	16
	100

Europe contains 2,793,000 square geographical miles, and 227,700,000 inhabitants; or about 81 to a square mile, or 1 to 8 acres.

Asia 12,118,000 miles, and 390 millions of inhabitants; 32 per square mile, 1 to 20 acres.

Africa 8,516,000 miles, and 60 millions of inhabitants; or 7 per square mile, or 1 to 115 acres.

America 11 millions of miles, and 39 millions of inhabitants; or 3½ to every mile.

The Cape of Good Hope, Buenos Ayres, and Botany Bay are in *the same latitude*, 33 to 35 *south*; and equal to Nankin, Bagdad, Cairo, Gibraltar, Madeira, Bermudas, and Charles-Town *north*.

Ceylon, Sierra Leone, and St. Fé, are in 8 or 9 *north*, and Truxillo, Olinda, Congo, and Java the same *south*.

London is nearly in the same north latitude, 51 and 52, as the Fox Islands, Winnepeg Lake, Antwerp, Berlin, Warsaw, and the south point of Kamschatka; and as Patagonia, *south*.

Philadelphia, 40 deg., is in the same *north* latitude as Madrid, Naples, Samarcand, and Niphon, in Japan.

Paris, in 49 deg., is in the same *north* latitude as Brest, St. John's, Newfoundland, Nootka Sound, Vienna, Astracan, and Pekin; and as Bass's Strait to the *south*.

Rome, 42, the same as Boston, Trebizonde, and North Corea.

The Galipagos, Quito, the Amazon's Mouth, Thomas's Island, Sumatra, and Borneo, are on the equator.

The most northern known land is Spitzbergen, lat. 80°; and the most southern, Trinity land, in 66°, but other land more south has lately been discovered.

At 10 degrees distance, or 691 miles from London, very nearly, are Bergen, Gottenburgh, Bornholm, Dresden, Prague, Lintz, Mantua, Barcelona, Toledo, Madrid, Ferrol, and the Faro Islands.

At 20 degrees, or 1380 miles, the coasts of East Greenland, Madeira, Morocco, Lepanto, Adrianople, Ismael, Smolensko, Petersburgh, and Tornea.

At 50 degrees distance, 3460 miles, are Cabul, Kandahar, Rostak, Mocha, Gulf of Guinea, Bermudas, Philadelphia, New York, and lake Ontario.

Jamaica is 68 degrees from London, Panama 77, Berbice 65, the Azores 24, Rio Janeiro 84, St. Helena 67, Cape of Good Hope 88, Bombay 63, Cape Comorin 76, Madras 74, Calcutta 72, Delhi 61, Constantinople 22½, Jerusalem 33, Mecca 44, Astracan 31, Moscow 23, Tobolsk 38, Vienna 11, Rome 13, Palermo 17, Marseilles 9, Algiers 16, Cairo 32, Sierra Leone 44, of 69·15 miles.

In calculating the distance of places on the Globe, the latitudes and longitudes being given, and the longitude reduced to measure at equator, the ratio is as radius is to the cosine of the difference of latitude, so is the cosine of the difference of longitude to the cosine of the degrees in the distance, which by 69·15 are the miles. The shortest method is by compasses on a globe.

There are 14 Republics in N. and S. America, besides the fine country of Brazil, called an Empire.

28 United States	14 millions		Washington.
Mexico	8	——	Mexico.
Central Amer. ..	2	——	Guatemala.
Hayti	1	——	Haytien.
La Plata	2½	——	Buenos Ayres.
Peru	2	——	Lima.
Chili	1½	——	St. Jago.
Bolivia	1½	——	Chuquisaca.
Granada........	1½	——	Bogota.
Venezuela	¾	——	Caraccas.
Paraguay	½	——	Assumption.
Equator....... .	¾	——	Quito.
Uraguay	¼	——	Monte Video.
Texas..........	¼	——	La Bahia.
Brazil..........	5½	——	Rio Janeiro.

The population of the Globe, for the two last centuries, was estimated at 1000 millions; but modern calculators in 1825, reduce it to 650 or 700 millions. If, then, a doubling took place every 25 years, according to an absurd theory, the population in 1800 could have been but 300 millions. In 1775, but 150 millions. In 1750, but 75 millions; and in 1700, but 13¾ millions. In the reign of Charles II. but 9¼ millions, and in the time of James I., even when public writers estimated the population at 1000 millions, there ought only to have been Adam and Eve in Moses's Paradise. Comparing deaths with births, doubling, under favourable circumstances, really takes place in only about 260 years. But it may be doubted whether, in the aggregate, the Earth was not as populous in the age of Augustus. At all events, there is no data to draw an accurate deduction between any two remote periods.

Population and Extent of Nations, above 1,000 Sq. Geographical Miles.

According to Balbi.

	Population. Thousands.	Geog. sq. m.	Pop. to sq mile
Europe ..	227,700	2,793,000	82
Asia	390,000	12,118,000	32
Africa ..	60,000	8,500,000	7
America	39,000	11,146,000	3 5
Oceanica	20.300	3,100,000	6·5
Total	737,000	37,637,000	19·6

According to Weimar Almanack.

	Population Thousands.	Geog. sq. m.	Pop. to sq. mile.
Europe ..	221,906	3,134,652	61
Asia	461,196	17,238,188	26·7
Africa ..	107,615	10,787,063	9·9
America	42,164	14,755,006	2 8
Oceanica	2.695	3,347,840	0·8
Total	835,578	49,263,448	16·9

EUROPE.

States.	G. squ. miles.	Population. Thousands.	Pop. sq. mile.	Rev. mil. ster.	Army.
United Kingdom	90,950	23.400	257	60	100,000
France - -	154,000	31,000	208	40	279,057
Switzerland -	11,900	1,980	177	·04	33,758
German Confed.	68,500	13,000	193	10	122,249
Bavaria - -	22,120	4,070	184	3	35,800
Wurtemburg -	5,720	1,520	266	1	13,955
Hanover - -	11,125	1,550	139	1·1	13,054
Saxony - -	4,341	1,400	314	1·2	12,000
Baden - -	4,480	1,130	252	1	10,000
Hes.-Darmstadt	2,826	700	248	·45	6,195
Hesse-Cassel -	3,344	592	177	·42	5,679
Saxe-Weimar -	1,070	222	204	·2	2,100
Mecklenb.-Sch.	3,592	431	120	·24	3,580
Oldenburg -	1,820	241	126	·06	1,650
Nassau - -	1,446	337	233	·15	3,028
Brunswick -	1,126	242	215	·24	2,096
Austria -	194,500	32,000	165	1·8	271,404
Prussia - -	80,450	12,464	155	9	162,600
Holland - -	8,326	2,302	277	4	26,000
Belgium - -	9,700	3,816	392	3·5	47,000
Sardinia - -	21,000	4,300	205	4	46,807
Parma - -	1,660	440	264	·5	1,800
Modena - -	1,570	390	238		1,790
Tuscany - -	6,324	1,275	202		4,000
States of Church	13,000	2,590	199	14	7,400
Two Sicilies -	31,460	7,420	236	20	51,510
Portugal - -	29,150	3,530	121	4	29,645
Spain - -	137,400	13,900	101	15	90,000
Swed. & Norw.	223,000	3,866	17	2	45,201
Sweden - -	127,000	2,800	22	1·8	33,201
Norway - -	96,000	1,050	11	1·4	12,000
Denmark - -	16,500	1,950	119	6·2	30,838
Russia - -	1,535,700	56,500	37	19	710,000
Russia Proper -	1,490,000	52 575	35	17	674,000
Poland - -	36,700	3,900	106	1·5	36,000
Turkey - -	112,500	7,100	63	14·5	300,000
Servia - -	9,000	380	42	-	-
Wallachia -	21,600	970	45	·55	-
Moldavia - -	11,600	450	39	·21	-
Greece - -	11,800	600	51	·25	11,800

ASIA.

States.	G. squ. miles.	Population. Thousands.	Pop. sq. mile.	Rev. mil. ster.	Army.
China - -	4,070,000	170,000	42	40	914,000
Japan - -	180,000	25,000	139	10	120,000
Annam - -	210,000	12,000	57	4	90,000
Siam - -	152,000	3,600	24	1·7	30,000
Birmania - -	153,000	3,700	24	1·8	35,000
Singhia - -	29,760	4,000	134	1·1	20,000
Nepaul - -	40,000	2,500	63	·5	17,000
Seikhs - -	130,000	8,000	62	·3	60,000
Sindley - -	40,000	1,000	25	·6	50,000
Cabul - -	110,000	4,200	38	1 2	150,000
Belouches -	110,000	2,000	18	——	150,000
Herat - -	50,000	1,500	30	·35	8,000
Persia - -	338,000	9,000	26	3·6	80,000
Bukharia - -	60,000	2,500	42	·5	25,000
Khiva - -	110,000	800	7	——	100,000
Khokhan - -	58,000	1,000	17	——	100,000
Yemen - -	40,000	2,500	63	·3	5,000
Mascat - -	39,000	1,600	41	·19	2,500
Foreign Possessions.					
English - -	840,650	114,430	135	-	-
East India Co.	349,000	80,600	231	·11	210,000
Trib. to E. I. Co	485,000	32,800	68	-	-
Nizam - -	72,000	10,000	138	·2	20,000
Nagpour - -	53,000	3,000	57	·6	11,000
Mysore - -	20,000	3,000	148	1·2	6,000
Oude - -	15,000	3,000	201	1·9	5,000
Guicowar -	13,600	2,000	147	·8	22,000
Indore - -	8,600	1,200	140	·85	34,000
Sattarah - -	8,000	1,500	183	·15	4,000
Travancore -	5,800	900	155	·35	11,000
Ceylon - -	15,650	830	53	-	-
Asiatic Turkey	556,000	12,500	23	-	-
Asiatic Russia -	4,010,000	3,600	0·89	-	-
Portuguese -	3,700	500	136	-	-

AFRICA.

States.	G. squ. miles.	Population. Thousands.	Pop. sq. mile.	Rev. mil. ster.	Army.
Morocco - -	130,000	6,000	46	1	26,000
Tunis - -	40,000	1,800	45	·3	6,000
Tripoli - -	208,000	660	3·2	·1	4,000
Tigre - -	150,000	1,800	12	-	-
Bornou - -	50,000	1,200	25	-	-
Fellatahs - -	70,000	1,700	24	-	-
Fouta-Toro -	15,000	700	47	-	-
Ashantee - -	100,000	3,000	30	-	-
Molouas - -	200,000	1,000	5	-	-
Changamera -	50,000	500	10	-	-
Madagascar -	120,000	2,000	17	-	-
Foreign Possessions.					
Turkish - -	367,000	3,000	3·2	4·1	70,000
Portuguese -	390,000	1,400	3·6	-	-
French - -	74,000	1,600	22	-	-
English - -	91,000	270	3	-	-
Spanish - -	2,430	208	86	-	-
American -	3,000	25	8·3	-	-
Arabian - -	4,000	100	25	-	-

AMERICA.

States.	G. squ. miles.	Population. Thousands.	Pop. sq. mile.	Rev. mil. ster.	Army.
United States -	1,570,000	11,800	7·5	6	5,779
Mexico - -	1,242,000	7,500	6	3·2	22,750
Central America	139,000	1,650	11 9	0 4	3,500
Columbia -	828,000	2,800	3·4	1·8	32,366
Peru - -	373,000	1,700	4·6	1·3	7,500
Bolivia - -	310,000	1,300	4·2	·5	-
Chili - -	129,000	1,400	10 1	·6	8,000
Rio de la Plata	653,000	700	1	·6	10,000
Banda Oriental	60,000	70	1·2	-	-
Paraguay - -	67,250	250	3 7	·1	5,000
Brazil - -	2,253,000	5,000	2·2	·4	30,000
Hayti - -	22,100	800	36	4·1	45,000
Independent Ind	6,000,000	1,300	0·2	·6	-
Foreign Possessions.					
English - -	1,030,000	1,900	0·98	-	-
Spanish - -	35,400	1,000	28	-	-
French - -	30,000	240	8	-	-
Dutch - -	30,000	140	3·8	-	
Danish - -	324,000	110	0·3	-	-
Russian - -	370,000	50	0·1	-	-

AUSTRALASIA.

States.	G. squ. miles.	Population. Thousands.	Pop. sq. mile.	Rev. mil. ster.	Army.
Siak (Sumatra)	20,000	600	30	-	-
Achem (Do.)	17.500	500	29	-	-
Borneo (Borneo)	30,000	400	13	-	-
Soulou (Do.) -	8,000	200	25	-	-
Mindanao -	12.100	360	30	-	-
Hawaii, S. I. -	5,100	130	26	-	
Dutch Isles -	203,000	9,360	46	-	-
Spanish Isles -	30,000	2,040	68	-	-
English Isles -	1,496,000	100	0·05	-	-
Portuguese Isles	8,000	137	17		-

Corrected Tables of Modern Determinations of LATITUDES *and* LONGITUDE *at* 400 *Places.*

Names of Places.	Lat. °	′	″		Long. °	′	″	
Aberdeen	57	8	56	N	2	5	42	W
Acapulco, Mexico	16	50	19	N	99	49	18	W
Acheen Head, Sumatra	5	36	0	N	95	19	0	E
Acre, Syria	32	54	35	N	35	6	20	E
Agra, India	27	14	30	N	78	17	0	E
Ajaccio, Corsica	41	55	1	N	8	44	4	E
Albany, United States	42	38	38	N	73	41	50	W
Aleppo, Turkey in Asia	36	11	25	N	37	10	15	E
Alexandria, Egypt	31	13	5	N	29	55	15	E
Algoa Bay, S. Coast Africa	34	1	0	S	25	40	0	E
Alicante, Spain	38	20	41	N	0	28	35	W
Amiens, France	49	53	41	N	2	18	11	E
Amsterdam, Holland	52	22	17	N	4	53	15	E
Ancona, Italy	43	37	54	N	13	29	7	E
Antigua, Caribbee Isles	17	4	30	N	61	54	45	W
Antwerp, Belgium	51	13	16	N	4	24	10	E
Archangel, Russia in Eu.	64	34	0	N	40	43	0	E
Ascension Isle, Atlantic O.	7	57	0	S	13	58	45	W
Astracan, Russia in Europe	46	21	12	N	48	2	45	E
Athens, Greece	37	58	1	N	23	46	14	E
Avignon, France	43	57	8	N	4	48	30	E
Aylesbury	51	49	3	N	0	48	41	W
Bab-el-Mandeb, Arabia	12	40	0	N	43	31	0	E
Bagdad, Turkey in Asia	33	19	40	N	44	24	45	E
Bahama Isle, Lucayos	26	43	30	N	78	56	0	W
Baltimore, United States	39	21	0	N	77	48	0	W
Banda I., Ind. Archipelago	4	31	0	S	130	0	0	E
Barbadoes I., Caribbee Is.	13	5	0	N	59	41	15	W
Barcelona, Spain	41	21	44	N	2	9	57	E
Basle, Switzerland	47	33	34	N	7	35	27	E
Batavia, Java	6	9	0	S	106	51	45	E
Bayonne, France	43	29	15	N	1	28	26	W
Beachy Head	50	44	24	N	0	15	12	E
Behring's Isle, Sea of Kamtschatka	55	36	0	N	167	46	0	E
Bencoolen, Sumatra	3	48	0	S	102	0	0	E
Bergen, Norway	60	24	0	N	5	20	0	E
Berlin, Prussia	52	31	45	N	13	22	15	E
Bermuda Isle, Atlantic O	32	22	0	N	64	30	0	W
Berne, Switzerland	46	56	55	N	7	26	15	E
Blanco C., W Coast Africa	20	46	55	N	17	1	45	W
Bologna, Italy	44	30	12	N	11	21	30	E
Bombay, India	18	53	45	N	72	56	0	E
Bonavista C., Newfoundl.	48	42	5	N	52	56	0	W
Bordeaux, France	44	50	14	N	0	33	50	W
Boston, United States	42	22	11	N	70	58	45	W
Boulogne, France	50	43	37	N	1	36	50	E
Bremen, Germany	53	4	38	N	8	48	0	E
Brest, France	48	23	14	N	4	28	45	W
Bridgewater	51	7	41	N	2	59	30	W
Brighton	50	49	32	N	0	7	40	W
Bristol	51	27	6	N	2	35	29	W
Bruges, Belgium	51	12	23	N	3	13	33	E
Brussels, Belgium	50	5	11	N	10	28	25	E
Buckingham	51	59	51	N	0	59	5	W
Buda, Hungary	47	29	41	N	19	2	30	E
Buenos Ayres, La Plata	34	36	40	S	58	24	30	W
Bussora, Turkey in Asia	30	29	30	N	47	40	0	E
Cader Idris, Wales	52	42	2	N	4	28	3	W
Cadiz Observatory, Spain	36	32	0	N	6	17	22	W
Caen, France	49	11	12	N	0	21	38	W
Cairo, Egypt	30	2	21	N	31	18	45	E
Calais, France	50	57	28	N	1	51	19	E
Calcutta, India	22	31	15	N	88	26	0	E
Callao, Peru	12	3	38	S	77	4	19	W
Cambridge Observatory	52	12	43	N	0	0	30	E
Campechey, Mexico	19	50	45	N	90	30	30	W
Canary Isle	28	10	0	N	15	31	0	W
Canlia, Candia	35	18	45	N	25	18	15	E
Canterbury	51	16	45	N	1	4	51	E
Canton, China	23	8	9	N	113	2	45	E
Caracas, Colombia	10	30	50	N	67	4	45	W
Cardigan Isle	52	7	53	N	4	40	27	W
Carmarthen	51	51	10	N	4	18	48	W
Carmel Cape, Syria	32	51	10	N	34	59	35	E
Carthagena, Spain	37	35	50	N	1	0	21	W
Cayenne, Guayana	4	56	15	N	52	14	45	W
Chelmsford	51	44	6	N	0	28	20	E
Cheltenham	51	54	7	N	2	4	6	W
Cherbourg, France	49	38	31	N	1	37	3	W
Cherson, Russia	46	37	46	N	32	38	31	E
Chester	53	11	26	N	2	53	1	W
Chichester	50	50	11	N	0	46	36	W
Chiloe Isle, Chili	41	53	0	S	72	54	45	W
Christmas Har., Tierra del Fuego	55	21	54	S	69	47	14	W
Christopher (St.), Caribbee Isles	17	19	0	N	62	49	6	W
Clear Cape, Ireland	51	25	0	N	9	29	0	W
Clermont-Ferrand, France	45	46	44	N	3	5	17	E
Colchester	51	53	18	N	0	53	34	E
Colombo, Ceylon	6	57	0	N	80	0	0	E
Comorin Cape, India	8	5	0	N	77	44	0	E
Constantinople, Turkey	41	1	27	N	28	55	15	E
Copenhagen, Denmark	55	41	4	N	12	35	6	E
Corinth, Greece	37	58	22	N	23	28	29	E
Cork Cove, Ireland	51	51	50	N	8	16	30	W
Coventry	52	24	25	N	1	30	5	W
Cracow, Poland	50	3	38	N	19	57	9	E
Cronstadt, Russia	59	59	26	N	29	49	30	E
Cumana, Colombia	10	27	37	N	64	9	45	W
Cuxhaven, Germany	53	52	21	N	8	43	1	E
Damietta, Egypt	31	25	43	N	31	49	30	E
Dantzic, Prussia	54	20	48	N	18	38	5	E
Dardanelles, Turkey	40	9	0	N	26	19	0	E
Daventry	52	15	39	N	1	9	3	W
Deal Castle	51	13	5	N	1	23	50	E
Delhi, India	28	37	0	N	77	40	0	E
Derby	52	55	32	N	1	28	16	W
Dieppe, France	49	55	34	N	1	4	44	E
Domingo, St Domingo	18	30	0	N	69	49	0	W
Dorchester	50	42	58	N	2	25	40	W
Dover Castle	51	7	47	N	1	19	7	E
Dublin Observatory	53	23	13	N	6	20	30	W
Dundee	56	28	0	N	2	56	0	W
Durham	54	46	31	N	1	34	6	W
Easter Isle, Pacific Ocean	27	9	33	S	109	25	20	W
Eddystone Lighthouse	50	10	55	N	4	15	3	W
Edinburgh Observatory	55	57	1	N	3	10	50	W
Elias Mt. N.W. coast Amer.	60	17	35	N	140	50	6	W
Elsineur, Denmark	56	2	17	N	12	38	2	E
Ely	52	24	49	N	0	16	35	E
Emden, Germany	53	21	3	N	7	11	1	E
Exeter	50	43	25	N	3	31	0	W
Farewell Cape, Greenland	59	42	0	N	45	16	0	W
Faro, Portugal	36	59	0	N	7	51	0	W
Fernando-Po I., Gf. Benin	3	28	0	N	8	40	15	E
Fez, Morocco	34	6	3	N	5	1	10	W
Finisterre Cape, Spain	42	54	0	N	9	16	0	W
Florence, Italy	43	46	41	N	11	15	45	E
Flushing, Holland	51	26	42	N	3	34	57	E
Folkstone	51	4	47	N	1	10	52	E
Foreland (North)	51	22	30	N	1	26	50	E
Foreland (South)	51	8	26	N	1	22	6	E
Formosa Isle, Chinese Sea	25	11	0	N	121	56	0	E
Francais C., St. Domingo	19	46	20	N	72	17	55	W
Frankfort on Maine, Ger.	50	7	29	N	8	36	0	E
Geneva, Switzerland	46	12	0	N	6	9	30	E
Genoa, Italy	44	25	0	N	8	58	0	E
Georgia Isle, Atlantic O.	54	58	0	S	36	15	0	W
Gibraltar, Spain	36	6	40	N	5	21	45	W
Glasgow, Scotland	55	51	32	N	4	16	0	W
Glastonbury Tor, England	51	8	43	N	2	41	19	W
Gloucester	51	52	3	N	2	14	15	W
Good Hope Cape, S. Africa	34	29	0	S	18	23	15	E
Goree I., W. Coast Africa	14	40	0	N	17	26	0	W
Gotha Observa., Germany	50	56	8	N	10	44	0	E
Gottenburg, Sweden	57	42	4	N	11	57	45	E
Gottingen, Germany	51	31	50	N	9	56	30	E
Greenwich Observatory	51	28	39	N	0	0	0	
Guadaloupe I., Caribbee I	15	59	30	N	61	45	0	W
Guam Isle, Pacific Ocean	13	21	0	N	144	20	0	E
Guayaquil, Peru	2	11	30	S	79	41	15	W
Hague, Holland	52	4	50	N	4	18	47	E
Halifax, Nova Scotia	44	44	0	N	63	35	15	W
Halle, Germany	51	29	5	N	11	58	2	E
Hamburg, Germany	53	32	51	N	9	58	37	E
Hanover, Germany	52	22	25	N	9	42	55	E
Hartlepool	54	41	49	N	1	10	21	W
Havannah, Cuba	23	9	27	N	82	22	53	W

Names of Places.	Lat. ° ′ ″	Long. ° ′ ″
Havre, France	49 29 14 N	0 6 38 E
Heligoland I., German O	54 11 34 N	7 53 13 E
Helena (St.) I., Atlantic O	15 55 0 S	5 43 0 W
Helvellin	54 31 43 N	3 0 21 W
Helvoetsluys, Holland	51 49 29 N	3 27 51 E
Holyhead	53 18 51 N	4 37 27 W
Horn C., Tierra del Fuego	55 58 30 S	67 21 14 W
Horsham, England	51 3 36 N	0 19 43 W
Hudson's House New Wales	53 0 32 N	106 27 20 W
Huntingdon, England	52 20 27 N	0 11 3 W
Hyeres, France	43 7 2 N	6 7 55 E
Icy C., NW. coast of Amer.	70 29 0 N	161 42 30 W
Ilchester	51 0 23 N	2 40 14 W
Ingleborough	54 10 4 N	2 23 18 W
Ispahan, Persia	32 24 34 N	51 50 15 E
Jaffa, Syria	32 5 25 N	34 46 8 E
Java Head, Java	6 48 0 S	105 11 0 E
Jerusalem, Turkey in Asia	31 47 47 N	35 20 15 E
John's (St.), Newfoundl.	47 33 45 N	52 39 45 W
Juan-Fernandez, Pacific O	33 40 0 S	78 58 15 W
Kidwelly	51 44 15 N	4 17 22 W
Kiel, Denmark	54 19 43 N	10 8 18 E
Kinsale, Ireland	51 41 30 N	8 28 15 W
Lancaster	54 3 8 N	2 47 41 W
Launceston	50 38 18 N	4 20 42 W
Leghorn, Italy	43 33 5 N	10 16 45 E
Leipsic, Germany	51 20 16 N	12 21 45 E
Lew-chew I. Chinese Sea	26 14 0 N	127 38 0 E
Leyden, Holland	52 9 30 N	4 29 13 E
Liege, Belgium	50 39 22 N	5 31 42 E
Lima, Peru	12 3 0 S	76 56 45 W
Lincoln	53 14 7 N	0 32 1 W
Lisbon Observ., Portugal	38 42 24 N	9 8 30 W
Litchfield	52 41 12 N	1 49 21 W
Liverpool	53 24 40 N	2 58 56 W
Lizard W.	49 57 44 N	5 11 5 W
Lomond, Scotland	56 14 57 N	3 17 4 W
London, St. Paul's	51 30 49 N	0 5 47 W
Londonderry, Ireland	54 59 28 N	7 14 49 W
L'Orient, France	47 45 11 N	3 21 2 W
Loughborough	52 46 31 N	1 11 54 W
Louisburgh, Cape Breton	45 53 40 N	59 54 45 W
Louvain, Belgium	50 53 26 N	4 41 46 E
Lutterworth	52 27 20 N	1 12 1 W
Lynn	52 46 52 N	0 25 4 E
Lyons, France	45 45 58 N	4 49 24 E
Macao, China	22 11 30 N	113 31 30 E
Madeira Funchal, Atlantic	32 37 0 N	16 54 46 W
Madras, India	13 4 0 N	80 22 0 E
Madrid, Spain	40 24 57 N	3 42 15 W
Mahon, Minorca	39 51 10 N	4 18 17 E
Maker Tower	50 20 52 N	4 10 16 W
Malacca Fort, India	2 12 0 N	102 15 0 E
Malaga, Spain	36 43 30 N	4 25 2 W
Malo (St.), France	48 39 3 N	2 1 11 W
Malta, Valetta, Mediterra.	35 53 0 N	14 30 35 E
Manchester	53 29 0 N	2 14 22 W
Manheim Obser. Germany	49 29 18 N	8 28 0 E
Manilla, Lucomia	14 36 0 N	120 58 0 E
Mantua, Italy	45 9 16 N	10 48 12 E
Marseilles Observ., France	43 17 49 N	5 22 15 E
Martinico I., Caribbee Is.	14 35 49 N	61 5 45 W
Matapan C., Turkey in Eu.	36 23 20 N	22 29 30 E
Mauritius I., Indian Ocean	20 9 45 S	57 29 30 E
May Cape, United States	38 56 46 N	74 53 6 W
Memel, Prussia	55 42 15 N	21 6 3 E
Messina, Sicily	38 11 30 N	15 35 30 E
Mexico, Mexico	19 25 45 N	99 5 15 W
Michael's (St.), Azores	37 48 0 N	25 13 0 W
Milan Observatory, Italy	45 28 2 N	9 11 31 E
Minehead	51 12 42 N	3 28 4 W
Mocha, Arabia	13 20 0 N	43 20 0 E
Montauban Obser., France	44 0 55 N	1 20 45 E
Montpelier Obser., France	43 36 16 N	3 52 40 E
Montrose	45 55 56 N	7 52 32 E
Moose Fort, New Wales	51 15 54 N	80 56 24 W
Moscow, Russia in Europe	55 45 45 N	37 33 0 E
Mozambique, E. of Africa	15 1 0 S	40 47 0 E
Mumbles	51 34 0 N	3 57 20 W
Munich, Germany	48 8 20 N	11 34 30 E
Nangasaki, Japan	32 43 40 N	129 52 7 E
Nankin, China	32 4 40 N	118 47 15 E
Naples, Italy	40 50 15 N	14 15 45 E
Needles	50 39 53 N	1 33 55 W
Newark	53 4 30 N	0 49 18 W

Names of Places.	Lat. ° ′ ″	Long. ° ′ ″
Newhiggen	55 11 14 N	1 20 42 W
Newbury	51 24 5 N	1 19 9 W
Nice, Italy	43 41 16 N	7 16 37 E
Nismes, France	43 50 8 N	4 21 45 E
Nizhnei-Novogorod Russia	56 19 43 N	44 28 30 E
Nootka, NW. Coast Amer.	49 35 15 N	126 36 40 W
Norfolk Isle, Pacific Ocean	29 1 45 S	168 10 15 E
North Cape, Lapland	71 10 0 N	26 0 45 E
North Cape, Russia	68 56 0 N	179 11 30 W
Nottingham	52 57 8 N	1 8 14 W
Odessa, Russia in Europe	46 30 22 N	30 45 22 E
Okhotsk, Russia in Asia	59 20 10 N	143 13 45 E
Oporto, Portugal	41 8 54 N	8 37 16 W
Orford	52 5 0 N	1 34 14 E
Orleans, France	47 54 12 N	1 54 41 E
Ostend, Belgium	51 13 57 N	2 55 8 E
Otaheite I., Pacific Ocean	17 29 15 S	149 30 24 W
Owhyhee I., Sandwich Is.	20 17 0 N	155 58 45 W
Oxford Observa., England	51 45 39 N	1 15 22 W
Padua Observatory, Italy	45 24 2 N	11 51 32 E
Palermo Observato., Sicily	38 6 44 N	13 22 0 E
Panama, Terra Firma	8 58 50 N	79 27 15 W
Para, Brazil	1 28 0 S	48 39 45 W
Paramatta Ob., N. Holland	33 48 45 S	151 1 15 W
Paris Observatory, France	48 50 14 N	2 20 23 E
Parma, Italy	44 48 1 N	10 26 45 E
Pavia, Italy	45 10 47 N	9 9 48 E
Pekin Observatory, China	39 54 13 N	116 27 45 E
Pelew Isles, Pacific Ocean	8 8 30 N	134 50 0 E
Pensacola, United States	30 24 0 N	87 11 30 W
Pernambuco, Brazil	8 3 0 S	34 54 0 W
Peterborough	52 35 40 N	0 14 45 W
Petersburg, Russia	59 56 23 N	30 18 45 E
Philadelphia, United Sta.	39 56 55 N	75 11 30 W
Phillips' Island	16 54 0 S	143 57 0 W
Pisa Observatory, Italy	43 43 11 N	10 24 0 E
Plymouth	50 22 20 N	4 7 16 W
Plynlimmon	52 28 3 N	3 46 4 W
Poole	50 42 50 N	1 58 55 W
Portland Lighthouse	50 31 22 N	2 26 50 W
Port Royal, Jamaica	17 58 0 N	76 52 30 W
Portsmouth Observatory	50 48 3 N	1 5 59 W
Prague, Germany	50 5 19 N	14 25 15 E
Prince's I. Straits of Sunda	6 35 0 S	105 15 0 E
Pr. Edward's I., Gulf of St. Lawrence	46 14 0 N	62 56 0 W
Providence Isle, Lucayos	25 5 0 N	77 19 0 W
Quebec, Canada	46 47 30 N	71 9 45 W
Quito, Peru	0 13 17 S	78 45 15 W
Reculver (South)	51 22 47 N	1 11 50 E
Retford (East)	53 23 58 N	0 54 3 W
Rhodes, Levant	30 26 0 N	28 15 0 E
Riga, Russia	56 57 1 N	24 7 45 E
Rio Janeiro, Brazil	22 53 0 S	43 12 0 W
Ripon	54 8 11 N	1 30 47 W
Rochelle, France	46 9 21 N	1 9 40 W
Rome, Italy	41 53 54 N	12 29 47 E
Rosetta, Egypt	31 25 0 N	30 28 20 E
Rotterdam, Holland	51 56 22 N	4 29 11 E
Rouen, France	49 26 27 N	1 5 59 E
Sable Cape, Nova Scotia	43 23 45 N	65 29 45 W
Salee, Morocco	34 5 0 N	6 42 45 E
Salisbury	51 3 56 N	1 47 24 W
Sandy Hook, United States	40 25 0 N	74 13 0 W
Santa-Fe de Bogota Colom.	4 35 48 N	74 13 53 W
Sark Isle, English Channel	49 23 32 N	2 24 30 W
Sebastian (St.), Spain	43 19 30 N	1 58 30 W
Sheerness Staff	51 11 22 N	0 44 26 E
Shrewsbury	52 42 28 N	2 44 53 W
Siam, India	14 20 40 N	100 50 15 E
Sierra Leone, W. of Africa	8 31 0 N	13 18 0 W
Sincapore, East Indies	1 12 0 N	103 30 0 E
Skiddaw	54 39 12 N	3 8 9 W
Smyrna, Turkey in Asia	38 25 0 N	27 6 0 E
Socotra Isle, Arabian Sea	12 30 0 N	54 10 0 E
South Cape, New Zealand	47 16 50 S	167 20 9 E
Southampton	50 54 9 N	1 23 56 W
Spartel Cape, Barbary	35 48 30 N	5 55 0 W
Start Point	50 13 26 N	3 38 21 W
Stockholm, Sweden	59 20 31 N	18 3 30 E
Strasburg, France	48 34 56 N	7 44 51 E
Stromboli I., Mediterran.	38 48 20 N	15 12 30 E
Stutgard, Germany	48 46 15 N	9 11 0 E
Suez, Egypt	30 0 30 N	32 28 0 E
Sunderland	54 56 12 N	1 24 16 W

B

Names of Places.	Lat. ° ′ ″	Long. ° ′ ″	Names of Places.	Lat. ° ′ ″	Long. ° ′ ″
Surat River, India . .	21 4 0 N	72 51 0 E	Valencia, Spain . .	39 28 45 N	0 23 3 W
Swan River, New Holland	31 50 0 S	115 50 0 E	Valladolid, Mexico . .	19 42 0 N	100 52 0 W
Swansea	51 37 13 N	3 55 32 W	Valparaiso, Chili . .	33 0 30 S	71 38 15 W
Syracuse, Sicily . .	37 2 58 N	15 16 10 E	Venice, Italy . . .	45 25 32 N	12 20 59 E
Tarsus, Turkey . .	37 1 0 N	34 52 0 E	Vera-Cruz, Mexico . .	19 11 52 N	96 8 45 W
Tenby	51 40 20 N	4 40 52 W	Verd C., W. coast Africa	14 43 45 N	17 30 30 W
Teneriffe I., Canary Isles	28 17 0 N	16 39 45 W	Verona Observatory, Italy	45 26 7 N	11 1 15 E
Tercera Isle, Azores .	38 39 0 N	27 14 0 W	Vienna, Germany . .	48 12 40 N	16 22 45 E
Ternate I., Indian Archi.	0 50 0 N	127 32 0 E	Vigo, Spain . .	42 13 20 N	8 33 30 W
Thebes, Egypt . .	25 43 0 N	32 39 21 E	Vincent (St.) Ca., Portugal	37 2 54 N	8 59 36 W
Thule (S.), Sandwich Land	59 34 0 S	27 45 0 W	Viviers Observa., France	44 29 14 N	4 41 0 E
Timor I., Ind. Archipelago	10 10 0 S	123 38 0 E	Wakefield . . .	53 41 2 N	1 29 24 W
Tinian Isle, Ladrones	14 58 0 N	145 51 15 E	Warrington . . .	53 23 30 N	2 33 11 W
Tobago I., Caribbee Isles	11 10 0 N	60 27 0 W	Warsaw, Poland . .	52 14 28 N	21 2 45 E
Tobolsk, Russia in Asia	58 11 42 N	68 6 15 E	Washington, United Sta.	38 55 0 N	76 58 45 W
Tornea, Sweden . .	65 50 50 N	24 12 15 E	Weimar, Germany . .	50 59 12 N	11 21 0 E
Toulon, France . .	43 7 9 N	5 55 41 E	Whitehaven . . .	54 32 50 N	3 34 56 W
Tours, France . . .	47 23 46 N	0 41 38 E	Whyda, W. coast of Africa	6 18 0 N	2 34 0 E
Trieste, Illyria . .	45 38 8 N	13 47 8 E	Wicklow	52 58 22 N	6 0 21 W
Trincomalee, Ceylon	8 33 0 N	81 22 0 E	Winchelsea . . .	50 55 28 N	0 42 31 E
Trinidad Isle, Caribbee I.	10 38 42 N	61 34 0 W	Winchester . . .	51 3 40 N	1 18 26 W
Tripoli, Barbary . .	32 53 40 N	13 11 33 E	Windsor Castle . .	51 29 0 N	0 35 28 W
Tristan d'Acunha, Atlantic	37 5 36 S	12 7 0 W	Winter Har., Melville I.	74 47 18 N	110 31 35 W
Tunbridge . . .	51 11 52 N	0 17 2 E	Wolverhampton . .	52 34 54 N	2 7 10 W
Tunis, Barbary . .	36 47 59 N	10 11 15 E	Workington . . .	54 38 34 N	3 33 30 W
Turin Castello, Italy .	45 4 0 N	7 40 15 E	Worm's Head . . .	51 33 56 N	4 18 56 W
Tynemouth . . .	55 1 21 N	1 24 31 W	Wrekin	52 40 11 N	2 31 30 W
Upsal, Sweden . .	59 51 50 N	17 39 0 E	York (New), United States	40 42 6 N	73 59 0 W
Uraniburg, Denmark .	55 54 38 N	12 42 59 E	York	53 57 48 N	1 4 34 W
Ushant Isles, France .	48 28 8 N	5 3 6 W	Zante Isle, Mediterranean	37 47 17 N	20 54 42 E
Utrecht, Holland . .	52 5 31 N	5 7 16 E	Zanzibar Rd., E. of Africa	6 6 0 S	39 33 0 E
Valdivia, Chili. .	39 50 0 S	73 34 0 W	Zurich, Switzerland .	47 22 33 N	8 31 30 E

Length, in Fathoms of Six Feet each, of a Degree of Latitude and a Degree of Longitude, in every Fifth Degree of Latitude, compression the 304th.

Lat.	Degree of Lat.	Long.	Lat.	Degree of Lat.	Long.
°			°		
0	60458·6	60857·1	51	60819·0	38374·5
5	60463·2	60627·0	52	60829·2	37543·7
10	60476·5	59938·4	53	60839·3	36701·4
15	60498·4	58796·3	54	60849·3	35847·8
20	60528·2	57208·8	55	60859·3	34983·1
25	60564·8	55187·5	60	60906·6	30503·5
30	60607·4	52746·9	65	60949·6	25788·7
35	60654·5	49904·9	70	60986·7	20874·8
40	60704·8	46682·4	75	61016·8	15729·3
45	60756·7	43103·0	80	61039·1	10601·4
50	60808·7	39193·5	85	61052·7	5321·4

Degrees of longitude in miles :—

At equator	68·732
10 degrees lat.	67·694
20	64·587
30	59·523
40	52·652
50	44·186
60	34·366
70	23·507
80	11·935
90	0·000

One degree of longitude is equal to 4 minutes of time; 1 minute of long. to 4 seconds of time; and 1 second of long. to 1-15th, or 0·0666 of a second of time.

Degrees of latitude in miles :—

Lat.	0	....	68·732
	12° 32′	....	68·743
	33 18	....	69·076
	40 —	....	68·630
	43 —	....	68·998
	44 44	....	69·061
	44 52	....	68·769
	45 —	....	69·092
	49 —	....	69·121
	49 22	....	68·945
	— —	....	69·119
	51 30	....	69·146
	53 15	....	69·545
	60 20 30″	..	69·292
	66 20	....	69·403

The mean of the 15 is 69·0448

ASTRONOMY.

We now proceed from the Earth and its productions, to the Heavens. No person, who, even in our own climate, has viewed the Vault of the Stars in the stillness of night, can be insensible of the impression which the contemplation imparts. It is, in its vastness and splendour, a glance at the infinite Universe, and the highest example of the sublime. It penetrates the soul with indescribable emotions of reverence for the Eternal Creator, and reminds man of his littleness, and his ephemeral character.

The visible stars are either the shoal of the Milky Way, of which our Sun is one of a million; or they are separate shoals equal to the Milky Way, seen through and beyond the others, but so distant, that the unaided eye recognizes them only as dull stars.

Of the magnitude which the eye thus embraces, we can form an estimate, by considering that the nearest star is not less than 60 millions of millions of miles distant; that each is probably as distant from its nearest; and that our shoal of the Milky Way contains, in its diameter, at least 1000 stars in line, each at that distance, rendering the whole shoal in breadth equal to 60 thousand billions of miles.

The distance then of other shoals, probably of equal size, seen by us almost as points, may be written, but cannot be conceived by an animal of 5 feet 9 inches, who grows old in 60 or 70 whirls of his own planet round one of these stars! What study, therefore, can be so inviting and exciting!

The bare spectacle of the Heavens, without any suspicion of its vastness and eternity, has, however, in every age forced the attention of mankind. It was, of course, a ready and speaking instrument of superstition. Its variations, owing to the Earth turning daily from West to East on the solar side of its axis; and moving in mass from East to West in its annual course round the Sun, were seized on as portents and prognostics, which created belief and reverence, just as the source was awful and sublime. This science of Astrology, therefore, became the religion of early nations, and the Priest, the Astrologer, and the Statesman, were united in cunning and mistaken persons. This alliance to self and to vanity, rendered the study of the stars one of the highest antiquity, and that which was pursued with the greatest industry, and fostered by the most lavish patronage.

Nor is this mere matter of history, for throughout Asia and Africa, it is now the only science of the great and studious; and even in Europe, Astrology was one of the liberal sciences till within two centuries. So late as our Revolution it was recognized by the governments of the Western nations. In the age of Anne every street and court in London had its thriving astrologer. Down to this time, Moore's Almanac recommends itself by its astrological predictions to 3 or 400,000 annual customers; and a few years since it retained, in one year, but a tithe of them, owing to a reforming spirit entering the Court of the Stationers' Company.

In a depth of time not to be penetrated, the course of the Sun in a year was divided into twelve equal parts, with names assigned by popular objects of the season, called the 12 signs of the Zodiac. The heavens were also divided into 12 similar parts, and these were called the 12 Houses. The Planets, then in their erratic courses, were daily changing their positions in the Zodiac, consequently, the *Horoscope*, or picture of the heavens, was constantly varying.

Absolute and relative significations were then affixed to each sign, each house, and each planet, with further modifications by aspect, in sextile, quartile, trine, or opposition; and by many prescribed rules and forms, the astrologer was at once bound and deceived. It was not considered that any other varying Key would answer the same purpose, though of any number of probable events, a given number would come true, whatever might be the Key. If the probability was even, then 50 of every hundred would happen as foretold, if 2 to 1, then 33; if 3 to 1, then 25, and so on. In this lay the mistake, for it was the error of inadvertency.

What a fertile source, however, of popular error, in which all common and uncommon sense were misled! Hence, half the temples of antiquity, and the millions squandered on them! It was believed, that there was a soul of the world which harmonized every thing, and hence the oracles, the dreamers, the auspices from the entrails of birds, animals, &c. &c.

Just, however, as Chemistry rose on the fancy about the philosopher's stone, and medicine out of the dream about the elixir of immortality; so the pursuits of astrology created the perfection of her daughter, Astronomy. For we find, that, 4 or 5000 years ago, the mean motions of the Sun, Moon, and Planets, were known to a second just as at present; and the motions of the Earth's and Moon's nodes, the latitudes of the planets, &c. were all adopted by astrologers in preparing horoscopes for any time past or future. Our modern observatories, no doubt have telescopes, and improved instruments, but the observatories at Benares, at Pekin, at Babylon, and at Bagdad, have been unrivalled in the size of their instruments, and the splendour of the establishments.

Nothing, therefore, can be more impertinent than the assertion of modern writers, that the accuracy of astronomical prediction arises from any modern theory. Theory may have suggested some unexplored corner, and increased the tables; but astronomy is strictly a science of observation, and far more indebted to the false theory of astrology, than to the equally false and fanciful theory of any modern.

Astrology and Astronomy took their rise in the East, where the splendour of the heavens far exceeds what our atmosphere permits. Their theory may be supposed to be that of Pythagoras, since he had been a soldier in the Persian service, before he be-

came a teacher of philosophy among the Greeks, who stole freely from the East. Ptolemy, in the native country of all superstition, has preserved to us the whole science of Astrology; but ambition led him, as is believed, to invent a new system, in which he made the Earth the centre with sundry mistakes, which the telescope would have prevented. This passed current for 1400 years, till Copernicus, in 1570, revived the Pythagorean system, in the face of which Tycho Brahe started another, now forgotten.

Down to this time, in spite of Bacon, the Catholic Church, and Tycho Brahe, the Copernican system has prevailed. But a reasonable motion of the Sun through space, discovered and established by Sir W. Herschel and others, tends to deprive us of those pretty pictures in concentric circles, except as resultants, which we have for two centuries been in the habit of calling the Solar System. For if the Sun has any power, it must be derived from motion; and if acting on bodies at a distance, like Jupiter on his moons, or the Earth on its moon, there must be an intervening medium to conduct its momentum through its system. The discovery of the motion of the Sun towards the constellation Hercules, gives, therefore, its due place to Motion as the source of all material power; for it is absurd to imagine power in the Sun without motion.

Bailly maintains, from oriental records, that astronomy was cultivated in Egypt and Chaldea 2500 B. C. In Persia 3200. In India 3101, and in China 2952.

The Indian tables of great antiquity make the tropical year within 1′ 53″ of our best tables. Other tables, equally accurate, appear to Bailly, Playfair, and other authorities, to have been constructed 3102 B. C. One of their zodiacs places Aldebaran 40′ before the vernal equinox, which carries it back to 3163 B. C. Other coincidences are astonishing, and prove the length of their observations and the perfection of their instruments. Thus the place of the Sun agrees with our best tables within 46′ 54″, and the Moon within 37′, yet our tables include minute anomalies of recent discovery.

The first recorded observatory was on the temple of Belus; the tomb of Osymandias, in Egypt, was another, and it contained a golden circle 200 feet in diameter, and that at Benares was at least as ancient as those.

The earliest Hindoos practised trigonometry and sexagesimal arithmetic. They taught that the earth was spherical, turned on its axis, &c., took latitudes and longitudes, knew the diameter of the earth to be 1600 yojanas, and the Moon's distance 51,370, or 32 diameters.—In one yug they say the Sun, Mercury, and Venus, or Surya, Budha, and Sucra, make 4,320,000 revolutions. They called the Sun *Surya*, Mercury *Budha*, Venus *Sucra*, Mars *Mangala*, Jupiter *Vrihaspati*, Saturn *Sani*, Moon *Chandra*.

According to the Chinese *Shoo king*, the periods of the planets, the Sun and Moon, were well known in the reign of Yao, 2357 B. C. Their observations, however, are mere records, and they had no tables by which to anticipate phenomena.

If the earlier rude Zodiac was of Egyptian origin, with Aquarius corresponding to their September, it must be above 10,000 years old. At the same time no other people would be likely to confer a sign on water, and it would be made to accord with the flood or fall of the Nile, appropriately followed by Pisces. If of Hindoo origin, the flood of the Ganges and the Nile nearly accord. It was divided into 28 parts, called Mansions of the Moon, as by the Chinese.

The so-called Zodiacs of Tentyra, &c. were mere Horoscopes of Nativities.

Tablets found in mummies give 28 parts to the Zodiac, one for every day of the Moon, and they begin with Aquarius.

The astrologers of Babylon are stated to have presented Alexander with astronomical observations during 430,000 years. Ignorant reporters mistook a period fixed by multiplication; it means moons or days. Yet the Chaldeans had made observations which extended 1903 years before the taking of Babylon by Alexander.

The Phœnicians sailed by the stars in the Great and Little Bear.

Job, Hesiod, and Homer, mention several of the constellations.

Democritus, a Greek, taught that the Milky Way was caused by innumerable stars. Nicetas and others taught the diurnal motion; while Pythagoras, who had been in India, taught the two-fold motions, and the modern system. He ascribed eclipses to shadows, and arranged the planets as in our Copernican system. The system of Ptolemy was his attempted improvement.

Pytheas, in 330 B. C., made the obliquity 23° 50′, and mentions the connection of the tides with the Moon.

Eratosthenes, in 276 B. C., made the obliquity 23° 51′ 20″. He, and Hipparchus in the same age, Ptolomy in 130, the Arabians in 800 and 900, and Ulugh Begh, in 1440, perfected the outlines of the science, and prepared the way for Copernicus, who, in 1543, allowed his system to appear. It is the system of the Chaldeans, and nearly the same that was taught by Pythagoras, and will always be believed by wise men.

Taautus among the Egyptians, Chiron among the Greeks, Zerdusht or Zoroaster among the Bactrians, and Hipparchus and Ptolemy in more recent ages, effected various services. Then the Sabeans and Astrologers were unremittingly active; and the names conferred on the planets after Saturn, and his Rhea family, united astronomy, astrology, and theology in tripartite veneration for above 3000 years.

The Caliph al Mamoun caused 2 degrees of the meridian to be measured in the plains of Sinjar or Shinar, and found a degree to be 57 Arabian miles.

The Chinese call Saturn Too, Earth fire, Jupiter Mo, and Mars Ho, Venus Ken, (metal,) and Mercury Shoog, (water.) The stars are divided like the provinces of the empire. The Zodiac has 28 constellations,

and the equator 12 parts, of 30°. In 2752, Fohi made astronomical tables, and, in 2697, the fixity of the Polar Star led to the invention of the armillary sphere by Yuchi. In 2513, Chueni began his reign, and in his time the Chinese record the visible conjunction of five planets, which, by calculation, actually took place in 2440.

The Arabian astronomers, under the Caliphs in 995, had a quadrant of 21 feet 8 inches radius; and a sextant 57 feet 9 inches.

The precision of Astronomy arises not from theories, but from prolonged observations, and the regularity of the mean motions, and the ascertained uniformity of their irregularities. Ephemerides of the planets' places, of eclipses, &c. have been published for above 300 years, and were, at first, nearly as precise as at present.

The Hindoos, &c. &c. nearly 500 years ago, were by observation quite as minute as we are, and the Bolognese Ephemerides of 1560, reduced every prediction to seconds, just as is done now. Even if theory or analogy has evolved some minutia, it is not by theory, for nature is never absurd.

The British Museum contains a copy of the original work of COPERNICUS on the Solar System. Its title is—

" NICOLAI COPERNICI TORINENSIS de REVOLUTIONIBVS ORBIUM cœlestium Libri VI. —Habes in hoc opereiam recens nato, et œdito studiose lector, Motus Stellarum, tam fixarum, quam erraticarum cum ex ucteribus, cum etiam ex recentibus observationibus restitutus; et noois insuper ac admirabilibus, hypothesibus ornatos. Habes etiam Tabulas expeditissimas ex quibus eosdom ad quodius tempus quam facilli me calculare poteris. Legitur eme, lege fruere.

Norembergæ apud Joh. Petreium,
Anno M D XLIII.

It is dedicated—

Ad Sanctissimum Dominum PAVLVM III. Pontificem Maximvm.

And there is a laudatory letter from NICOLAVS SCHONBERGIVS, Cardinalis Capuanus, Nicolaro Copernico, S. dated Rome. calend. Novembris, anno M D XXXVI.

It is a small folio of 196 pages, full of diagrams, and well printed, at the expence of the Liberal Cardinal.

John Field published, in London, a forgotten work on the Copernican system in 1556, 13 years after.

Tycho, Kepler, Galileo, Hevelius, Descartes, Gassendi, Newton, Huygens, Flamstead, Hook, and Halley, distinguished the next century; and though Bacon, &c. opposed Copernicus, the system finally triumphed.

Cardinal de Cutta advanced the doctrine of the motion of the Earth in 1420, in his De Docta Ignorantia.

In 1665, Newton, then in his 22d year, and a student at Cambridge, saw an apple fall from a tree, and speculating on the cause, conceived it arose from the Earth's attraction. He then imagined, that the Earth retained the Moon in its orbit by the same power, and the Sun the planets, and called it Universal Gravitation or weight. He then supposed it to emanate like an odour, or heat inversely, as the *square* of the distance. But as attraction causes the approach of bodies, and the moons do not fall to their primaries, nor the planets to the Sun, he ascribed to revolving bodies a projectile force to counteract the other at right angles. This is the Newtonian Philosophy, built step by step on gratuitous hypotheses.

Flamstead House was an ancient tower, altered and fitted as a Royal Observatory, in 1676. Without instruments, and a salary of only £100 per annum, during the 45 years of Flamstead. Halley then held the office 22 years; Bradley 20 years; Bliss 3 years; Maskelyne 45 years; Pond 28 years; and in 1835, Airy, with a salary of £800 besides a pension of £300.

There are regular Observatories at Abo, Altona, Bedford, Benares, Berlin, Bushey Heath, Calcutta, Cambridge, Cape of Good Hope, Dorpat, Dublin, Edinburgh, Geneva, Gotha, Gottingen, Greenwich, Kensington, Kew, Konigsberg, Lisbon, Manheim, Marseilles, Milan, Montauban, Oxford, Palermo, Paramatta, Paris, Pekin, Portsmouth, Slough, Tubingen, Uraniberg, Verona, Vienna, Viviers, and Woolwich.

All Observatories are provided with a mural or fixed circle for the declination, and a meridian circle for transits, to record right ascensions. There are also, azimuth and altitude circles, superior telescopes, and often an equatorial.

Greenwich has a transept circle by Troughton; a transit instrument of 8 feet by Bird; 2 mural quadrants of 8 feet, and Bradley's zenith sector. The telescopes are 40 and 60-inch archromatics, and a six-feet reflector. The Paris Observatory was built in 1667, that of Berlin in 1711, that of Nuremberg in 1678, at Bologna in 1714, and at Pisa in 1730, at Utretcht in 1690, at Copenhagen in 1656, at Stockholm in 1746, and at Lisbon in 1728. Latterly, every university has had its observatory; and there are also several private ones scattered over Europe and the United States, and one at the Cape, and New South Wales.

The best known telescopes are Fraunhofer's at Dorpat, 14 feet; and South's at Kensington, 20 feet.

There is now a society, in London, for the improvement of instruments, and the promotion of observatories.

Col. Lambton's trigonometrical survey of India, carried through 23 degrees of latitude, was made with the instruments carried out by Lord Macartney to the Emperor of China.

Kater's pocket altitude and azimuth circle, in a box 7 inches by 4½ and 3, determines angles within 5″. The level and the plumb-line are now superseded in Observatories by Kater's floating collimetor.

The Planets, or Solar System.

All those who have seen Jupiter and his 4 satellites, have an accurate idea of the Solar System as it would appear sideways. The Planets are to the Sun just what Jupiter's moons are to Jupiter. The Sun

moves through space in some more general but unknown connection, and carries with it the eleven Planets, and their satellites, acting and reacting as ONE SYSTEM.

There is the very same connection between the Earth and its moon, Jupiter, Saturn, &c. and their moons, and the Sun and the Planets. They resemble exactly a large body, and a small one at the ends of a balanced lever. They move *contrary* ways, the large body performing a *small* orbit, and the small bodies large orbits.

If moving in parallel right lines, their matter into their velocities would exactly balance; but, as the motion of each is produced by the reaction of the other, and therefore at necessarily *equal* distances, so the motion becomes circular, and the circle absorbs part of the force. The square of the circle or any part of it is consequently equal to the sum of the squares of the two forces; one producing the velocity, and the other the curvature.

It is thus in the Earth and Moon, in other planets and their satellites, and in the Sun and his system of satellites. Each primary performs a small orbit, and each secondary a large one; whether one or more, according to the preceding general principle.

It is a principle never to be lost sight of, that circular motion is a necessary result of equal action and reaction in contrary directions; for the harmony would be disturbed by variation of distance, if the motions were rectilinear. The same distance, that is, the same action and reaction, are therefore only to be preserved by reciprocal circular motions. No attraction and no projectile force are therefore necessary, and their invention must be regarded as blunders of a superstitious age.

The bodies appear to have met while moving contrary ways in space; and to have established their relative motions by their equal action and reaction through the intervening medium of space.

Of that medium we know little, except its transparency and homogeneity, and its serving as a material *conductor* of motion between the distant bodies within it. In universal nature, where there is indifference as to direction of motion, and neither up nor down, great rarity would be efficient in transferring the motions of correlative bodies; while great density would be no obstruction, as itself is the cause of the motions. We call that rare, or dense, as it presses little or much towards the Earth's centre; but the medium of space is quite independent of any such local action or pressure.

If the bodies came near while moving *the same way*, there would be no mutual *reaction*, and they would go together for want of reaction, and not owing to that mechanical impossibility, called attraction.

Necessary *equality* of distance with original motion, and mutual reaction, would produce unceasing orbits at equal distances, except so far as disturbed by other bodies.

There is but one Universal Law of all Nature, *action* in one direction of motion, and *reaction* in the contrary direction. It, however, supposes an intervening conductor of the momentum of each.

Motion, generating succession and time, is the ORDER of the Universe; and motion, generating relative power, is the PHENOMENA of the Universe, including the beginning and end of all developements.

A centre of a system like the Sun would operate like a great balance-wheel, and afford and receive compensation from all ordinary inequalities of action upon it.

The Sun's local orbit around his mechanical reaction to the system of planets, all in *contrary* motion, is about 1,660,000 miles from the centre of the system, and the plane of that local solar orbit is inclined 1° 34′ 15″ from our ecliptic. The Earth's local or terro-lunar orbit is about 4600 miles in diameter, equal to a menstrual equation of the Sun's place, of 10″ nearly.

This action and reaction is UNIVERSAL NATURE, and *large* and *small* orbits in *contrary* directions is UNIVERSAL NATURE! It is the only principle of planetary construction and economy, which is UNIVERSAL. We find it in every thing, and all things must be considered in relation to action and reaction, and to the balance of orbits in contrary motions. Circular motion is, in fact, necessary to the continuity of motion by reciprocity of action and reaction, at equal distances.

In *Mercury*, we can see with the best telescopes, only, that it is round, and exhibits phases. It is too much in the neighbourhood of the Sun.

Venus offers nothing remarkable, and is difficult to define with telescopes. Its illuminated part dazzles, and increases the imperfection of the telescope; yet it is not mottled like the Moon, and we perceive only a uniform brightness. Obscure portions are more fancied than real, and, in fact, we do not see the real surfaces, but only the atmospheres filled with clouds.

In *Mars*, we see distinctly continents of a ruddy colour, red and fiery, like red sandstone. The seas appear greenish. Brilliant white spots mark its poles, conjectured to be snow; for they disappear when emerging from the polar winter.

Jupiter is always crossed by bands or belts. These bands vary in breadth and in situation. They have been distributed over the planet, and branches from them, and subdivisions, as well as dark spots, are uncommon. It is the darker body of the planet which forms the belts.

Saturn's body is striped with belts, broader than Jupiter's. The ring is a solid opaque substance, throwing its shadow on Saturn, on the side next the Sun, and on the other side receiving the shadow of the planet. Extensive dusky spots on its surface are also seen. The *nodes of the ring* lie in 170° and 340° of longitude, and whenever the planet is in one or other of these longitudes, the Sun then illuminates only the edge of it.

In *Herschel*, we see only a small round uniform disc, without rings, belts, or spots.

We determine the angle which the Earth's disc makes at each of the Planets, by observations made by two observers on the same meridian, or by reducing their different meridians to the same. Then the angle of the Earth's diameter being known, we approximate the distance of the Sun.

The angle of the Earth's diameter at the Sun is about 17 seconds, at Mercury 28, at Venus 62, at Mars 42, at Jupiter 4, at Saturn 2, at Uranus 1, and at the Moon 6908·4, or 115 minutes.

The angle under which the Planets are seen from the Earth is Mercury 12 seconds, Venus 61, Mars 18, Jupiter 46, Saturn 18, Uranus 4, Sun 1923. Moon 2020 seconds.

206,265 (log. 5·314425) the ratio of one second, whose sine is 4·85, divided by the seconds subtended by each of the Planets, gives the number of semi-diameters of the Earth for each Planet.

Thus, for the *Moon*, 206.265 by 6908″·4, gives 29·857 diameters, or 236348·7 miles, as the *mean* distance.

Then the bulks are as the cubes of the diameters, as reciprocally seen. Thus the cube of the Earth's angle 4, at *Jupiter* is 64, and that of Jupiter 46 at the Earth, is 97,336, which is 1 to 1521, *i. e.* there are 1521 Earths in Jupiter. Their diameters are in the direct ratio of their angles, thus the Earth at Jupiter is 4, and Jupiter at the Earth 46, which is 1 to 11·5. Then, taking the Earth's diameter at 7924 miles, that of Jupiter becomes 91,126 miles.

The Earth and *Mercury* are as 28 and 12, or 2·333 to 1, and 7924 by 2·333 is 2698 miles for Mercury. Cubing we get 21,952 to 1728, or 12·7 to 1 in bulks, so that 12·7 Mercuries make 1 Earth.

In the *Sun* it is 17 to 1923, so that the diameter of the Earth to the Sun is 113·1 to 1, and the Sun's diameter 896,346 miles, and the Sun is equal to 1,477,400 Earths.

Then, in the *Moon*, the mean angle of the Earth is 6908 seconds, and that of the Moon 1885,—hence their diameters are 3·66 to 1, and that of the Moon is 2165 miles. The bulks as 49·047 to 1.

In the same way *Uranus* is 31,696 miles in diameter, and 64 times the bulk of the Earth.

Venus, a trifle less than the Earth, about 125 miles.

Mars 3396 miles in diameter, and 1-127th the bulk.

Saturn 71,316 miles, and 729 times the Earth's bulk.—*Herschel.*

The Sidereal periods of the planets in decimals are

	Days.	Daily Motions. °	′	″
☿	.... 87·969258	4	5	32·6
♀	... 224·7007869	1	36	7·8
⊕	.... 365·2563612	0	59	8·3
♂	.... 686·9796458	0	31	26·7
♃	.... 4332·5848212....	0	4	59·3
♄	.... 10759·2198174 ..	0	2	0·6
♅	.... 30686·8208296 ..	0	0	42·4

The four Asteroids vary from 1325 days to 1686.

The daily velocities of the Planets in their orbits in miles are

☿	2·649000
♀	1·901500
⊕	1·602400
♂	1·317150
♃	615850
♄	526220
♅	370010

The motion per 10th of a second of space is, Mercury 17·98 miles, of Venus 32·97, Earth 45·16, Mars 69·813, Jupiter 237·5, Saturn 436·3, and Herschel 872·66.

The Earth moves in its orbit 65,578 miles an hour. Mercury 107,800 miles per hour. Venus 78,900 miles. ♂ 54,350. ♃ 29,420. ♄ 22,240, and Herschel 15,320.

The Moon, in her terrestrial orbit, moves 2275 miles an hour.

The motion per day by the relative bulk or volume, indicating the orbit momentum, is in Mercury 1,054,302, in Venus 1,853,962, in the Earth 1,602,400, in Mars 1,830,828, in Jupiter 788,840,000, in Saturn 523,600,000, Herschel 297,800,000.

We find the central and tangent forces of Mercury to be 745,500, Venus 1,311,000, the Earth (exc. moon) 1,126,900, Mars 1,294,600. Jupiter 557,800,000, (exc. moons), Saturn 370,230,000, and Herschel 21,060,000, which, as will be seen, exhibit no law whatever, though the figures, moons excepted, express the ratio of the fall, or central force of each.

In every year, or revolution of the Earth, ☿ performs 4·152 revolutions, and ♀ 1·625. The Earth performs 1·881 revolutions in the period of ♂; 11·8617 in the period of ♃; 29·46 of ♄; and 84·01 of ♅.

At Earth's distance 93,340,000, every second or degree in the orbit is 452·525 miles; and every second of time equal to 18·583 miles. Every million + or— is 4·95 miles, or 2000 feet.

The *inclinations* of the Planet's orbits to the plane of our ecliptic are—

	°	′	″
Mercury	7	0	9
Venus	3	23	28
Moon	5	8	49
Mars	1	51	6
Vesta	7	8	9
Juno	13	4	9
Ceres	10	37	26
Pallas	34	34	55
Jupiter	1	18	51
Saturn	2	29	35
Herschel	0	46	28
Sun's axis	82	44	0
Moon's axis	88	17	0

The continental astronomers make the axis rotation of Mercury 1, the Sun 25·5, Venus ·973, Earth 997, Mars 1·027, nearly alike. Jupiter ·414, and Saturn ·428.

The *rotation* on the axis—

Sun .. .. *days*	25	14	8	0
Mercury	0	24	5	0
Venus	0	23	29	59
Earth	0	23	56	4
Mars	0	24	39	22
Jupiter	0	9	56	0
Saturn	0	10	29	17

Of the Rotations our observations are very uncertain, but the four first are taken to be about 24 hours each, and Jupiter and Saturn about 10 hours each. The Sun is taken with more probability at 25 days, 12 months, and the Moon in a sidereal revolution, or 27 days, 7 hours, 43 minutes.

The Nodes fall back in a century, on two authorities.

	′	″		′	″
Mercury ..	71	40	..	72	10
Venus ..	60		..	51	40
Earth ..	83	49	..	83	49
Mars ..	46	40	..	46	40
Jupiter ..	60		..	59	30
Saturn ..	53	20	..	55	30
Herschel ..	26	40	..	26	74

The line of *Apsides* moves in 100 years—

In Mercury	1	33	45
In Venus	1	21	0
Earth	1	43	10·8
Mars	1	51	40
Jupiter	1	34	33
Saturn	1	50	7
Herschel	1	29	2

The mean motions of the apsides of *all* the Planets, (if correctly taken) is 1° 37′ 37″, (the Earth being 1° 43′ 11″) in 100 years.

The difference between the greatest and least distances is twice the eccentricity.

The eccentricity, half the major axis being 1, is Mercury, ·2055; Venus, ·00686; Earth, ·01678; Mars, ·0933; Vesta, 0·89; Juno, ·2578; Ceres, ·07843; Pallas, ·24538; Jupiter, ·048162; Saturn, ·05615; Herschel, ·04668.

The relative distances, squares of the distances, and inverse squares, are as under—

	Dist.	Squares.	In. Squares.
☿	·387	·15	6·66
♀	·723	·523	1·9
⊕	1·000	1·000	1·000
♂	1·524	2·323	0·4304
♃	5·2	27	0·037
♄	9·539	90	0·0111
♅	19·18	368	0·002717

The Sun is equal to 20,610,000 Mercurys, to 1,520,000 Venuses, to 1,328,460 Earths, 9,394,000 Mars, 973 Jupiters, 1390·4 Saturns, and 1595·5 Herschels.

A Sun, two feet in diameter, would correspond with Mercury as a mustard-seed, with the Earth and Venus as a pea, Mars as a pin's head, the Asteroids as grains of sand, Jupiter as an orange, Saturn a small one, and Herschel as a plum; their orbits varying from 164 feet to 8000 feet.

The Sun is 65 million times larger than the least of Jupiter's moons, and 1048 times larger than Jupiter, and 1047·7 larger than Jupiter and his 4 moons, so that the 4 moons are but the 3500th of Jupiter.

The diameter of the satellites of Jupiter are 1″·105; 0″·911; 1″·488, and 1″·273. Jupiter's satellites are from 6 to 26 of his semi-diameters distant; Saturn's from 3 to 20, and 1 of 59; Herschel's 13 to 45, and 1 of 91.

The orbits of 6 of Saturn's satellites are in the plane of the ring, but the 7th nearly coincides with the ecliptic.

Herschel's satellites are inclined 78° 58′, and their motions retrograde.

Jupiter's satellites are from 2068 to 3377 miles in diameter.

Saturn's Ring is double, and the nearest is three times as broad as the other, one being 20,000 miles broad, and the other 7200. The space between them is 2839 miles. The exterior ring is 205,000 miles in diameter. The inner ring is 33,000 miles from the body of Saturn. It is said to rotate in 11 hours 16 minutes, and the outer part in 17 hours 10 minutes. The ring is 1.118th of Saturn.

Saturn flattens towards the Poles, and the longest diameter is at 43° 20′, to the equatorial as 36° to 35°, while the polar is but 32°. This vast Planet turns in 10 hours 16 minutes, and the ring seems like the middle parts, thrown off by its great centrifugal force.

The minor axis of Saturn's ring was, in April, 1832, but 4″·54, and on September 30 but 0″·01, the major axis being 43″·2 and 36″·92; and, in 1833, the minor, from March to July, is less than 1″, and in April, May, and June 0″, and invisible, the major being 45″ to 40″.

Struve finds that the rings of Saturn are slightly eccentric.

The plane of Saturn's rings is that of his equator, a further proof that the ring is an effect of centrifugal force. If the Earth's rotation was such that parts flew off in tangents, they would be likely, at a given distance, to produce the regular form of a ring.

The difference of time between Jupiter's eclipses at his greatest and least distance is 16 minutes 26·6 seconds; and the aberration from the velocity of light is 20″·37 in perihelion, and 20″·5 in aphelion.

Before the Opposition, or so long as Jupiter passes the Meridian in the morning, the shadow of the satellites is to the *west* of the Planet, and the *immersions* on that side. But, *after* the Opposition, the *emersions* happen to the *east*.

Airy makes the distances of Jupiter 497,491,000, and Saturn 893,955,000. He takes the Earth's mean distance as 93,726,900 and period 365·2564.

The distance of Herschel from the Sun is 10,000 times the distance of Herschel from the mid-distance of the nearest fixed Star.

The axes of Jupiter are as 107 to 100, an

analogical proof of the spheroidal figure of the Earth.

At Jupiter, the Earth emerges but 12° from the Sun, at Mars 17°, Venus 8°, and Mercury but 4°. Of course, all invisible at Jupiter.

When the elongation of Venus is 39° 44′ between its inferior conjunction and greatest elongation, it appears brightest; for then, though its phasis be but the 53.200ths of a circle, it is so much nearer the Earth than in its superior conjunction, when it appears with a perfect disc, that the want of surface is more than compensated by intense light. In that situation, Venus is often seen by the unassisted eye in broad day-light. When Venus is to the west of the Sun, it rises before the Sun, and is called a morning star, this appearance continuing about 290 days together.—When it is to the east of the Sun it sets after, and is called an evening star, for about the same period of 290 days.

Spots have been said to be seen on Venus; but Herschel saw only a dark and enlightened atmosphere. Schroeter saw a mountain 22 miles high, another 19, and two others 11, and he makes the rotation 23 h. 20′ 54″. Many have believed that they have seen a satellite, distant 66½ semi-diameters. Venus never goes above 48° from the Sun.

There will be no transit of Venus till Dec. 8, 1874; and no other till 2004.

Venus and Mercury, in approaching the body of the Sun at distances from 65′ to 46′, display no refraction of a local solar atmosphere. So, also, Jupiter's satellites have no refraction when close to his body.

Mars often presents 1-10th of his dark side to the Earth, and Venus 9-10ths and more. But when Venus presents 9-10ths of her illumined surface she is very brilliant.

Mercury never moves above 28° from the Sun, and therefore never rises or sets above 1 hour 50 min. before or after the Sun, and is seldom seen.

If all the known Planets were assembled in one, it would be the 557th of the Sun; and with equal forces it would be 590 millions of miles distant.

The Planet Herschel was discovered with a five-foot achromatic telescope, on the 13th of March, 1781. Flamstead registered it as a fixed Star.

Herschel is in Pisces, and will be in Aries from 1813 to 1850.

The asteroid Pallas is but 79 miles in diameter, not 250 round.

In 2500 B. C., all the Planets were in conjunction, by computation and Chinese Record; and again, in 1186, in Libra. But including Uranus, &c. a general conjunction can occur only in 17 billions of years.

A circle, whose diameter is a million of miles, has nearly 5 miles in every second of its periphery, and 291 miles in every minute of its periphering. Then, as a minute is the least visual angle by the average of eyes, so at the distance of a million of miles any object less than 291 miles in diameter is invisible. But if a telescope with light and power of 500 is used, then the eye sees equal to 500 minutes, and shews an object $\frac{291}{500}$ or the 0 58 of a mile. Ten millions is a tenth more throughout, and a telescope shews no object below 5 8 miles, and the naked eye discerns no object less than 2910 miles in diameter, the size of a minute. So at 100 millions, the times of Jupiter and Saturn are as 5 to 2, or 72 to 29, and the return to similar positions in 850 years.

Thirteen periods of Venus is nearly equal to 8 of the Earth, and they return to similar positions in 239 years.

Four of Mercury is about 1 of the Earth. 2 of Venus is equal to 5 of Mercury. 3 of Venus to 1 of Mars. 3 of Saturn is about 1 of Herschel.

The 17 satellites revolve as under—

	♃			♄			♅		
	d.	h.	m.	d.	h.	m.	d.	h.	m.
First	1	18	28	0	22	37	5	21	25
Second	3	13	14	1	8	53	8	17	1
Third	7	3	43	1	21	18	10	23	4
Fourth......	16	16	32	2	17	44	13	11	5
Fifth	....			4	12	25	38	1	49
Sixth	....			15	22	41	107	16	40
Seventh	....			79	7	54			

The 4th satellite of Jupiter is 25·998 semi-diam. Jupiter from the centre. The 7th of Saturn is 64 359 semi-diam. And the 6th of Herschel is 91·008 semi-diam.

The Elements of an orbit are, 1. the Major Axis; 2. The Eccentricity; 3. The longitude of the Perihelion; 4 The inclination to the Ecliptic; 5. The plane of the ascending Node; 6. The periods; and 7. The longitude at a fixed time.

275 Revolutions of Jupiter's first satellite are finished in the time of 137 of the second, and 68 of the third, *i. e.* as 4, 2, 1, in 486½ days, invariably and constantly, and the effect is obviously mechanical and arithmetical. The conjunctions of the second and third always take place on the side opposite those of the first and second; for the difference between the first and third is 2 days over, and the 1 day comes between. The time of the fourth is to the third as 7 to 3.

The Planets are attached to the Sun exactly on the same principle of mechanism as a body on the Earth is attached to the Earth. 1. The Sun *progresses* through space, carrying with it the planetary system and the medium in which they are placed, just like Jupiter and his Moons in the solar system. 2. They are *deflected* into orbits by the Sun's rotation on his axis, acting on the medium of space, and around the mechanical centre of the whole system, from the line of the solar motion. The two forces, therefore, the *progressive force* and the *deflecting force*, generate a resultant diagonal force, by which each Planet in its orbit is still attached to the central Sun.

The Sun is constantly and invariably in

the exact centre of the whole solar system. The Planets vary their distance, by moving between the tangent force and the central force, but are every where governed by the Sun's two motions, and some are in Perihelion, and others in Aphelion, as local results. As a Planet is not in two places at once, so orbit and foci are imaginary.

Equality of distance would occasion the Planets, as seen at the Sun, to revolve in circles. Each Planet, from another Planet in motion, would perform a very perplexed course. Seen sideways, the Planets would move backward and forward in right lines. Seen from above or beneath, by an eye at rest, with a progressing Sun, they would present changing disorder, some before the Sun, some after, &c. &c.

The courses of the Planets in their progression with the Sun, are not, in fact, circles, or regular curves, but *wavy lines*, such as our Moon describes in her orbit in progression with the Earth, or as a nail in the tire of a wheel describes while the wheel is turning round, and also advancing. As seen from the moving Sun, they appear as though they performed orbits; but, in space, each actually moves in its own *wavy line*, always at the same distance from the Sun, but the line never returns into itself.

The orbit momentum is the hypotheneuse of two equal forces at right angles, and the square-root of half its square are the legs of the triangle and the measure of the forces; we thus approximate the forces of each.

Irregularities in planetary motions correct themselves, because every motion, included in the motion of the Sun, is itself subordinate, and therefore must ultimately conform. The Planets being acted upon by the common force of the Sun, they often interfere on the same side with the Sun's force on that side, and this begets irregularity or disturbance, oddly called their own attractions.

La Grange proved that the mass of each planet into the square-root of the line of apsides, and into the square of the eccentricity, give sums which are invariable.

The change in the distances of the planets, producing a resultant ellipse, arises from varied reaction in the planets, and not from any varied action of the Sun, seeing that their several Aphelia and Perihelia are in all parts of the heavens; and the Sun as to each day's motion may be considered as the true centre of the actions and reactions, the elliptical focus of an orbit being a picture rather than a reality.

Every planetary orbit is the diagonal of the progressive motion of its primary, through space, creating a force towards the line of direction of the primary; and of a force of mutual reaction through the medium of space which operates tangent-wise, contrarily, and reciprocally, just like a large and small body revolving horizontally at the ends of a rod.

The longitude of the Perihelion is the distance of the perihelion from Aries. The eccentricity is the ratio of perihelion distance to the mean distance, or half the major axis. The true anomaly is the angle of the radius vector with the major axis.

The greatest equation of the centre is the greatest difference between the mean motion and the true motion, and the measure of the eccentricity.

The mean distance of a planet from the Sun is half the line of apsides or major axis.

The ancient astronomers made as many spheres or heavens as planets and varieties in their motions. Eudoxus made 23, Aristotle 47, and Ptolemy 9.

The existence of a gaseous medium coextensively with space, renders the *gratuitous hypothesis* of gravity quite unnecessary, since it would be the effect of the reactions of such medium to make bodies of certain sizes and distances go round each other when moving *contrary ways*, and approximate only *when moving the same way*.

To accommodate the hypothetical law of Universal Gravitation to the phenomena of the Planets, astronomers have preferred to change the mean density of matter itself; and the Earth, for comparison, being taken at a density of 1000, to accommodate Mercury to the assumed law, it is taken as 2585—Venus 1024—Mars 656—Jupiter 201—Saturn 103—and Herschel 218. Consequently, we have the paradox, that Jupiter, 1290 times larger than the Earth, contains but 323 times more atoms. Saturn 1107 times larger, but 114 times more atoms; even the Sun, according to these theorists, is but one-fourth the density of the Earth? There may be differences, and larger Planets may be denser, but chemistry, and all the laws that unite and compound atoms, are utterly at variance with so rash and wild an hypothesis.

The law or means by which bodies reciprocally move one another, is altogether out of question. It signifies not, whether the rod which connects two bodies turning on a pivot with equal momenta is gold, or steel, or fir. So any law between bodies in reciprocal motion and equal momenta is equally foreign to arithmetic and philosophy. The Earth and Moon, for example, move round a fulcrum with velocities inversely as their masses; what, then, have we to do with the law of the supposed something that connects them, and that is the very same for both? We believe that they move thus, because originally moving contrary ways, and that their masses then regulated their distance; but if any law is imagined, it is the same for the Earth as for the Moon, and the same for the Moon as for the Earth, and of no relevancy.

As there must be a medium in space, as a transmitter of forces, and as the producer of Uniform Phænomena in the Planets, &c. so it may be presumed to consist of the active elements of our own terrestrial system.

As time and motion are convertible, and as, in a system of *equal* action and re-action, no motion is gained or lost, so no time is gained and lost, and time is, therefore, a local generation adapted to the circle of organizations in a system, (like a clock in its case, &c.) and is not duration in a general

or absolute sense. It follows, also, that the GOD of all systems does not exist in the varied times of all, but is a genuine eternity, or absolute duration, quite independent of all our Earth-born successions either of time or motion.

We draw a Solar System as a series of concentric orbits, but this refers only to our vision as a mental centre. The planets move only in right lines deflected from their rectilinear direction by the Solar vortex, so as to keep, by equal action and reaction, the *same distance* from the Sun. A similar case is that of our Moon, which makes the shew of an orbit, by keeping at *the same distance*, but, in fact, describes in the Earth's vortex, the Earth's orbit in lines concave only to the Sun. It is the same with other satellites, and with all the planets, as Solar satellites.

Elliptical orbits are necessary consequences of inclinations of their planes, to the mean plane of the Solar motion. In passing from one extreme declination to another, the mean distance will be as the radius, but the two points of the apsides will be as the cosine and secant, and these in the Earth, at a mean angle of 10° 25′, exactly accord with the near and remote distances in the perihelion and aphelion.

There cannot be a reasonable doubt that all circular motion in nature is the effect of action and reaction. The only question between the Schoolmen and the Editor of this Work, is, whether the action and reaction are purely mechanical, or whether they are effects of the gratuitous principle of reciprocal attraction and projectile force.

Rotation is caused by want of conformity of shape, or of uniformity in density. Additional matter, or inequality in the size of a moving boat, causes impediment on that side, and a deviation in the line of progress. Rotation, indicates a medium, and that the shape or density is unequal.—*Burney*.

Newton's imaginary projectile force implies an impulse from no known general cause, and is understood to be neither continued, repeated, or renewed. But the mechanical effect of a single impulse is not sufficient for the purpose.—*Ibid.*

Kepler rationally supposed the Sun to have a motion on its axis, and that its atmosphere made each planet revolve in the plane, or nearly so, of the Equator. No doubt such an atmosphere would act on the medium of space; but Kepler did not suspect the progression, though Galileo had in his time discovered the Solar rotation.

Space has its centre every where, and its periphery no where.

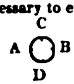
Burney thinks that some Comets may rotate with an axis in the direction of its progress.

The Planets and Satellites all move round the Sun from West to East, nearly in the same plane, a clear proof that all are subject to the same mechanical action and reaction, which even La Place, &c. considers as that of an extended fluid medium.

Vesta is about 223 millions miles distant from the Sun. Juno and Ceres, 250; and Pallas, 260; with periods of 3 and 4 years.

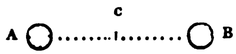
Attraction and Gravitation.

It is waste of time to break a butterfly on a wheel, but as astronomy and all science is beset with fancies about attraction and repulsion, it is necessary to eradicate them.



If we suppose the little circle to represent a body at rest, it is evident that without some foreign force it can never move. But if acted on at A, it can be moved towards B; or if at B, towards A. The force being on the side contrary to the resulting motion.

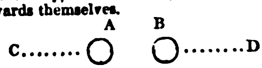
So if any wind, or gaseous current, act at D, it is carried to C, or if any current at C, it is carried to D, the force being always on the side contrary to the resulting motion.



But, if there are two bodies, and it is required to move A to C, (in like manner as above) the force moving A to C must proceed from the side A. Either some impact, or some involvement of a motion towards C, must act at A, to carry A to C. The modern schools, however, assert, that B may move A to C, and A move B to C, and this is mutual attraction! Hence, it is necessary to believe that B acts on the side A, where B is not present; and that A acts on B on the side B, where A is not present. In other words, A is required to be where it is not, and also be in force at B, so as to move B to C. All which is absurd.

If in any case A and B approach, it is not because A moves B towards itself, or B moves A towards itself, but owing to some causes which affect the space in which A and B are situated; and which causes act on A at A, and on B at B. The determination of these causes is knowledge, while the statement that A moves B, and B moves A, is ignorance, and is what is meant by attraction. It is also worse than ignorance to justify idleness, by asserting that the true cause is indifferent; or to justify ignorance, by asserting that it is unknowable!

This reasoning applies to every species of Attraction, whatever may be the pomposity of equivocal terms in which it is described. Universally, bodies cannot push other bodies towards themselves.



If A and B are said to repel one another, and that B makes A move to C, and A makes B move to D, we have to bear in mind, that while A is moving to C it is in force only in that direction, and cannot, therefore, be moving B towards D. In like manner, while B is moving to D, it is in force only in that direction, and cannot, therefore, be in force in the contrary direction so as to move A to C.

Every species and variety of Attraction and Repulsion are therefore absurd.

Matter is in all cases the conductor of motion. If a body moves, it is because it is the patient of some sufficient momentum of body or matter acting *on* the side *from* which the body moves, and only in force in that direction.

Some adopters of attraction, &c. talk by false analogy, of *drawing*, others of *pulling*, *lifting*, &c. La Place invents gravitating atoms, and gives them a velocity of 6000 times that of light, which, in some way, (known only to himself) performs the work of bringing the body in; others imagine little hooks! As to drawing, pulling, &c. it behoves them to shew the tackle, the levers, the ropes, &c.!

Once for all, it may now be observed, that the vacuum, does not attract the mercury from the basin up the closed tube—that the glass does not attract liquids in open tubes—that bungs floating on water are not attracted by one another, (since if of treble the density in the water, or of beech, they do not go together)—that atoms are not attracted in crystallization—that sugar, sponge, &c. do not attract water—since in each, and all of these cases, the atmospheric pressure, intercepted on one side, is the palpable and sufficient cause. Nor in electricity and magnetism, is there any attraction, because the force of elementary re-union between the opposed sides of the excited plate is the sufficient cause. In no case does the body jump over the other body, to push it towards itself.

So, in like manner, the experiments of Cavendish on lead balls, and of Maskelyne on a plummet at Schehallien, were ridiculous fallacies. They were simple cases of the mutual interception of elastic pressure, or, like ships, in each others' wake, at sea.

In spite of all the learning, ingenuity, and elaborations of men, confessedly very able, if there is not and cannot be any action of the nature of attraction, and if the phenomena ascribed to it are local effects of palpable local causes, and if all the phenomena and involvements may be clearly explained on different principles, then it may be to be lamented that so much ability and character should have been wasted, while a respect for truth and sound reasoning demands that the whole should be forgotten as a dream, or demolished as a card-house.

The Stars.

Space infinite, in which a million of million of miles is as a grain of sand to the Earth, presents to the human imagination overwhelming objects. But, as matter of fact, space is filled with clusters of stars, or systems, in some kind of mutual connection. To approximate the subject, a second of a degree, or the 1,296,000th of a great circle, at 50 billions of miles distant, is equal to 242,400,000 miles, and a minute equal to 14,544,000,000 miles. At 100 billions distant is 484,800,000 miles in a second of a degree, or 29,088,000,000 in a minute; so that at 200 billions distance, what appears to us but as a minute of a degree, is really about 60,000 millions of miles in diameter. 200 billions is, however, a small distance in space, and 200 times 200 is the probable distance of many visible objects; in that case, our 60,000 millions to a minute becomes 2,000,000 millions, for the space which a minute subtends at the earth.

Hence, at that distance, and even less, millions of objects of vast size must be altogether invisible, for the eye sees no object much below two minutes; so that at the distance of 4000 billions of miles, all objects below 24,000,000 millions of miles in diameter, would be to us as though they did not exist; while, at 50 billions distant, all objects below 29,100 millions in diameter, could never be suspected to exist.

Yet what are the distances intimated, to the distances of nebulæ from which light, according to Sir W. Herschel, is 48,000 years travelling! Light travels 6½ trillions of miles per annum, then in 48,000 years this would be 304,000,000,000 of millions of millions of miles distant. If the cluster ceased to exist, we should not know it for 48,000 years.

Hence, though millions of stars are visible with telescopes, yet, in the same extent of space, other millions must be unseen!

Hipparchus, in 128 B. C., made a catalogue of 1022 Stars, all that can be seen with the naked eye. Flamstead, with telescopes, made another of 5884. Bode, in 1800, of 27,000; and Lalande, same year, of 50,000. Herschel computed 50,000, in nearly 6 square degrees of the Milky Way.

Kepler calculates that, in a spherical space, only 13 points can be equally distant; at twice the distance 52; and at thrice 117, which corresponds nearly with the number of Stars of first, second, and third magnitudes.

Ptolemy's constellations were 48.—Hevelius added 12, and Halley 8.

There are 34 northern constellations, 28 of which are ancient; and 45 southern, 14 of which were ancient.

The Stars of the first magnitude are—

Aldebaran........	in Taurus.
Castor	in Gemini.
Regulus..........	in the Lion.
Spica	in Virgo.
Antares..........	in Scorpio.
Dubhee..........	in the Great Bear.
Capella	in Auriga.
Arcturus	in Bootes.
Vega	in Lyra.
Deneb	in Cygnus.
Achernar	in Eridanus.
Betelguese	in Orion.
Canopus..........	in Argo.
Sirius	in the Great Dog.
Procyon........	in the Little Dog.
Cor Hydræ	in Hydra.
Fomelhaut	in the Southern Fish.

The British catalogue contains 17 Stars of the first magnitude, 79 of the second, 223 of the third, and 510 of the fourth magnitude, being those commonly discerned by

the naked eye. It gives 695 of the fifth magnitude. and 1604 of the sixth magnitude; in all 3128.

The twelve Signs of the Zodiac, and the numbers of stars recorded in them in the tables, are as follow—

♈ Aries	67	♎ Libra	53
♉ Taurus	143	♏ Scorpio	37
♊ Gemini	87	♐ Sagittarius	73
♋ Cancer	37	♑ Capricornus	54
♌ Leo	101	♒ Aquarius	119
♍ Virgo	117	♓ Pisces	115

The Zodiac was a rude means of recording the succession of seasons, and invented in very early ages in Egypt, Ethiopia, or Chaldea. It is simply what it professes, a memento of seasons: and its signs have no occult or econdite meaning.

It seems probable, that Aristarchus readjusted the zodiacal signs, for the present advance of 29 degrees carries us back 2088 years, near the age of Aristarchus. The Balance and Virgo determine the equinox and harvest, and accord beyond all question.

The Pleiades would be on the vernal equinoctial colure in 2338 B. C.

Space seems to be occupied with *clusters of Stars*. each Star serving as a separate Sun to planets and systems. The clusters are of all forms. The Milky Way is like a tuning-fork, and all the visible single Stars belong to it, besides myriads invisible.

In the *Pleiades*, telescopes show 50 or 60 large stars crowded together in a very moderate space, comparatively insulated. *Coma Berenice* forms another such group, more diffused, and consisting of larger stars. In the constellation Cancer is a multitude of stars. In the sword-handle of Perseus is another, crowded with stars. It is impossible to count the stars in one of these *globular clusters*. Many must contain 10 or 20,000 stars, wedged together in a round space, not a 50th of the Moon.

In Feb. 1814, Sir W. Herschel, the prince of astronomers, read to the Royal Society the results of thirty years' observations on Nebulæ. He conceived that the Stars form independent systems among themselves; that our Sun is part of that shoal or system, which we call the Milky Way; and that all the Stars of the first, second, and third magnitude belong to that vast cluster. The Stars. he remarks, are not spread in equal portions over the heavens, but are found in patches, each containing many thousands, and many more than the eye can separate from the mass of the *Cluster*.

Herschel considered *the milky way* to be a nebulæ or cluster of Stars, in nearly the middle of which is our Sun, all the separate visible Stars being part of it. He counted 2500 similar nebulæ or clusters in the heavens, and the number has since been doubled.

In the crowded part of the Milky Way, Herschel had fields of view containing no less than 588 Stars: and these continued many minutes, so that, in a quarter of an hour, he saw 116,000 Stars pass through the field of a telescope of only 15′ aperture: and at another time, in 41 minutes, he saw 258,000 Stars pass through the field.

The Milky Way consists mostly of Stars of the 10th or 12th magnitude, but too numerous to be seen by the eye.

The naked eye can discriminate Stars to the 6th or 7th magnitude, but powerful telescopes reach even to a 16th magnitude. All above the 6th are telescopic, and, except in clear nights, few can be seen.

Inghirami fixed the positions of 75,000 Stars in 15 degrees by 30 near the Equator.

The *North Polar Star*, in the tail of the Little Bear, is distinguished by the Great Bear, remarkable for having four stars of the second magnitude, forming the square of the Great Bear. If a line be drawn northward through the two westernmost stars of the square, called *the pointers*, it will pass close to the Polar Star, and within one degree of the Pole itself. The Polar Star and Dubhe form, also, an equilateral triangle with the easternmost star in the tail of the Great Bear.

Cassiopeia is a constellation directly opposite to the Great Bear, with respect to the North, so that a line drawn from the centre of the Great Bear, by the Polar Star a, would pass through the middle of Cassiopeia, on the other side of the Pole. This constellation is formed by stars in form of a Y.

The *Little Bear* is a constellation of nearly the same form as the Great Bear parallel to it, but reversed. The Polar Star, at the extremity of the tail, is of the third magnitude.

Arcturus is the principal star in Bootes, and of the first magnitude; it is distant from the tail of the Great Bear about 31° south-east. The two last stars in the tail of the Great Bear form a line which passes near Arcturus

Lyra and *Capella*. When the constellation of the Great Bear is on the meridian, two bright stars of the first magnitude are observable; that on the east side is named Lyra, or the bright star in the Harp; and that on the west side is called Capella. A line westward, through the two northern stars of the Great Bear, leads to Capella.

The *Dragon* is a constellation situated on a line drawn from the northernmost star of the square of the Great Bear, by the guards of the Little Bear, between Lyra and the Little Bear, where the four stars in the head form a kind of lozenge

Orion is a remarkable constellation, formed by three stars of the second magnitude, situated close to each other in a right line. The three are called Orion's Belt, and serve to point out the Great Dog Star, Sirius, to the south-east, and the Pleiades, or Seven Stars, to the north-west, in the neck of the Bull. To the south of the three stars in Orion's Belt is a row of stars called his Sword, and the nebulous stars of Orion.

Aldebaran is a bright star of the first magnitude, forming the south eye of the Bull. It is near the Pleiades, 14° S. E.

Procyon, or the Little Dog, forms, with

Sirius and the Belt of Orion, nearly an equilateral triangle.

Castor and *Pollux* are two stars of the second magnitude, situated near each other in the middle of the space between Orion and the Great Bear: the northern is Castor, the southern Pollux. A line drawn from Rigel, the south-east star of Orion, by the eastern star in his Belt, will pass between Castor and Pollux. Pollux is distant 45° E.N.E. from Aldebaran.

The *Lion* is a constellation formed by a large trapezium, wherein is a star of the first magnitude named Regulus. A line drawn from Rigel in Orion, through Procyon in the Little Dog, will lead to Regulus, which is about 37° from Procyon to the north-eastward, and about the same distance E.S.E. half E. from Pollux. A line drawn from the northern Polar Star through its pointers, passes 12° of Regulus.

Cancer, or the *Crab*, is a constellation formed of many small stars, whose nebulæ are a cluster of stars less visible than the Pleiades: they are situated on a line drawn from the middle of the Twins by Regulus, or on a line drawn from Procyon to the tail of the Great Bear.

The *Ram* (*Aries*,) is formed principally of two stars, one of the second, the other of the third magnitude. This constellation is pointed out by a line drawn from Procyon to Aldebaran; which, continued, leads to the southward of Arietis, which is about 23° to the west of the Pleiades.

The middle of the constellation *Perseus* is formed by three stars, one of which is of the second magnitude; they form the segment of a circle turned towards the Great Bear. A line drawn from the North Polar star to the Pleiades, passes through the middle of Perseus; a line drawn from the Belt of Orion by Aldebaran, passes through the head of Medusa, which Perseus holds in his hand, in which is a star of the second magnitude, named Algol, not always of the same brilliancy.

The *Swan* is a remarkable constellation, that assumes nearly the form of a large cross, in which is a bright star of the second magnitude. A line drawn from the Twins by the North Polar star, leads to the Swan on the opposite side, at nearly the same distance from the Polar Star on the one side, as the Twins are on the other.

The square of *Pegasus* is formed by four stars of the second magnitude; the northernmost star of the square is in the head of Andromeda. A line drawn from the Belt of Orion through the star Arietis in the Ram, leads to the bright star in the head of Andromeda. A line drawn from the Pleiades by the S. side of the star Arietis, leads to the star Algenib in the extremity of the wing, which is one of the four stars that form the square; the other two are to the westward; the northernmost one is called Scheat, and the southernmost one Markab, or Pegasi, about E. by N. 45° from the star in the Eagle called Aquilæ, and W. 44° from the star Arietis in the head of the Ram.

A line drawn through that diagonal of Pegasus, formed by the stars Algenib and Scheat, to the north-westward, leads to the bright star in the tail of the Swan. Another diagonal line, from Markab through the head of Andromeda, towards the N.E., passes near the bright star in the centre of Andromeda, and also near the star at the foot of Andromeda, dividing into three equal parts the space comprehended between the head of Andromeda and the centre of Perseus. They are nearly in a line between the constellations of the Ram and Cassiopeia.

In May, towards nine o'clock in the evening, when the middle star in the tail of the Great Bear is on the meridian, above the Pole, the bright star, Spica, is seen on the meridian to the south, about 28° of altitude. It is situated about 51° E.S.E. from Regulus, and forms an equilateral triangle with Arcturus in Bootes, and the bright star Deneb, distant 35°. At the same time, about 16° S.W. of Spica, is a trapezium, formed by four principal stars in the constellation of the Crow; a line drawn from Lyra, through Spica, leads directly to them.

A line from the two stars in the square of the Great Bear, nearest the tail, by Regulus, leads to a star of the second magnitude, the Heart of Hydra, about 23° to the S. of Regulus. The head of Hydra is a little to the S. of Cancer, between the stars Procyon and Regulus.

Crater, or the *Cup*, is situated between the Crow and Hydra.

Lyra, the bright star in the Harp, and one of the most brilliant, forms nearly a right-angled triangle with Arcturus and the Polar Star, the right-angle being next Lyra. This is one of those stars that never set at London.

Corona Borealis, or *Northern Crown*, is a small constellation near Arcturus, on a line drawn from Arcturus to Lyra. It is seven stars in a semicircle.

Aquila, or the *Eagle*, contains a bright star of the second magnitude, named Altair, situated about 34° S. by E. from Lyra, and 48° W. by S. from Pegasi, the south-western of the square of Pegasus. Altair is the centre of three stars.

A line passing E. by Regulus and Spica, near the ecliptic, passes through *Scorpio*, in which is a star of the first magnitude, Antares, about 46° E.S.E. from Spica, with 26° of south declination. It is red.

In the constellation *Libra* are two stars of the second magnitude, one in each scale: the one in the northern scale is nearly in a line drawn from Arcturus in Bootes, to Antares in Scorpio; the southern scale is between Spica and Antares, the three being near the ecliptic.

Sagittarius contains many stars of the third magnitude, forming a large trapezium. This constellation is situated on a line drawn from the centre of the Swan through the middle of the Eagle, at about 35° to the S. of the Eagle. The Swan is about the same distance from the Eagle N.

PLACES OF FORTY PRINCIPAL STARS, BY BRINKLEY

	Mag.	R. A. 1830.	An. Var. R. A.	Dec. 1830.	An. Var. Dec.
		h. m. s.	s.	° ′ ″	″
γ Pegasi - - -	2·3	0 4 29 29	+3·07	14 14 20 16 N	+20 07
α Cassiopeiæ -	3	0 30 54 54	+3 33	55 36 11·98 N	+19 85
α Arietis - - -	3	1 57 36 29	+3·35	22 39 17 96 N	+17 37
α Ceti - - - -	2·3	2 53 23 86	+3·12	3 25 5·51 N	+14 52
α Tauri - - -	1	4 26 10 25	+3 42	16 9 37 56 N	+ 7 88
α Aurigæ - - -	1	5 4 8·37	+4·41	45 48 55 30 N	+ 4 57
β Orionis - - -	1	5 6 22 13	+2·87	8 24 15 27 S	+ 4·65
β Tauri - - -	2	5 15 32 88	+3 78	28 27 19 48 N	+ 3 74
α Orionis - - -	1	5 45 55 05	+3·24	7 22 5·03 N	+ 1·24
α Canis Maj. - -	1	6 37 39 58	+2·64	16 29 19 55 S	— 4 45
α Geminorum -	3	7 23 44 30	+3·84	32 15 11 08 N	— 7 20
α Canis Min. - -	1·2	7 30 23 81	+3 14	5 39 16·07 N	— 8 72
β Geminorum -	2	7 34 53 98	+3·68	28 25 46·38 N	— 8 08
α Hydræ - - -	2	9 19 13·89	+2 94	7 55 30 81 S	—15 28
α Leonis - - -	1	9 59 18 43	+3 20	12 47 42 27 N	—17·32
β Leonis - - -	2·3	11 40 22 79	+3 06	15 31 21 75 N	—20 04
β Virginis - -	3·4	11 41 50 33	+3·12	—	—
α Virginis - -	1	13 16 14 65	+3 14	10 16 14 98 S	—19·00
α Bootis - - -	1	14 7 54·42	+2·73	20 4 17 54 N	—18·98
α 1 Libræ - -	6	14 41 17 68	+3 29	—	—
α 2 Libræ - -	3	14 41 29·11	+3 30	15 19 45·61 S	—15·33
α Cor. Borealis -	2	15 27 29·35	+2·53	27 17 32 62 N	—12·44
α Serpentis - -	2·3	15 35 53 82	+2 94	6 58 1·29 N	—11·74
α Scorpii - - -	1	16 18 59 62	+3 65	26 2 44 16 S	— 8·59
α Herculis - -	3·4	17 6 53 81	+2 72	14 35 27·51 N	— 4·57
α Ophiuchi - -	2	17 27 2 61	+2 77	12 41 27 84 N	— 3 08
α Lyræ - - - -	1	18 31 10 87	+2 02	38 37 50 20 N	+ 3·00
γ Aquilæ - - -	3	19 38 10·49	+2 85	10 12 20·41 N	+ 8·32
α Aquilæ - - -	1·2	19 42 29·12	+2·92	8 25 34·45 N	+ 9·04
β Aquilæ - - -	3·4	19 46 57 56	+2·94	5 59 21 02 N	+ 8 54
α 1 Capricorni -	4	20 8 13 00	+3·33	13 1 35·22 S	+10 63
α 2 Capricorni -	3	20 8 36 81	+3·33	13 3 52 24 S	+10·66
α Cygni - - -	1	20 35 38 09	+2 03	44 40 36·13 N	+12 58
α Aquarii - - -	3	21 57 2 87	+3 08	1 8 29·55 S	+17 23
α Piscis Aust. -	1	22 48 14 32	+3·33	—	—
α Pegasi - - -	2	22 56 17 73	+2 97	14 17 33·66 N	+19 27
α Andromedæ -	1	23 59 36 81	+3 07	28 9 7 51 N	+19 91
α Ursæ Min. - -	2 3	0 59 35 36	+15·50	88 24 8·54 N	+19 37
α Ursæ Maj. - -	1·2	10 53 9·66	+3 80	—	—
γ Draconis - - -	2	17 52 39 56	+1·39	51 30 44·94 N	— 0·69

α and δ Ursæ Minoris from Bessel

α Ursæ Minoris, 1830	2·3	0 59 30·76	+15·48	+88 24 8·22 N	+19·37
or Polaris. 1840		1 2 10 32	+16·47	+88 27 22 43 N	+19·30
1850		1 5 0 29	+17·53	+88 30 35 40 N	+19·24
1860		1 8 1·73	+18 78	+88 33 47 64 N	+19·16
δ Ursæ - - 1830	3	18 27 5 13	—19·16	+86 35 5 70 N	+ 2 36
Minoris. - 1840		18 23 53 03	—19 24	+86 35 27 93 N	+ 2·08
1850		18 20 40 21	—19 30	+86 35 47 36 N	+ 1·80
1860		18 17 26 77	—19 36	+86 36 3 97 N	+ 1 52

Bessel, in 1837, makes Sirius R. A. 6° 37′ 57″·8. Dec. 16° 29′ 53″·9. Lyra 18° 31′ 25″·2 and Dec. 38° 38′ 8″·5. The Pole Star 1° 1′ 22″·4 and Dec. 88° 26′ 24″.

A line drawn from Antares northward to the Pole, crosses *Ophiucus*, or the *Serpent Bearer*, and *Hercules*. A line from Antares to Lyra, passes through the head of the Serpent Bearer, near to Hercules.

Capricornus is on a line drawn from Lyra through the Eagle.

Fomalhaut, in the mouth of the Southern Fish, is a star of the first magnitude. It is about 60° S.E. from Aquilæ, and 45° S. from Pegasi. It is of high southern declination, its altitude never exceeding 20° in the latitude of 40°.

The *Dolphin* is a small constellation about 15° to the E. of the Eagle, formed by a lozenge of four stars.

Aquarius is distinguished by a line drawn from the bright star Lyra through the Dolphin. A line drawn from the Dolphin to Fomalhaut, in the mouth of the Southern Fish, passes between two stars in the shoulders of Aquarius.

Cetus, the *Whale*, is situated to the S. of Aries, or the Ram, below the space between the Pleiades and the square of Pegasus. A line drawn from the bright star in the head of Andromeda, between the two stars in the head of the Ram, leads to a star in the Whale, at about 25° south-east from the Ram.

Pisces, the *Fishes*, is composed of stars the least remarkable; one of them is situated to the south of the square of Pegasus, the other is more northerly and easterly, between the head of Andromeda and that of the Whale. The star in the knot of the line that unites the Fishes, the most remarkable of the constellation, is situated in a line drawn from the foot of Andromeda by the head of the Whale, and about 40° W. of Aldebaran, on a line drawn from the foot of the Twins, by Aldebaran.

Lepus, or the *Hare*, is a constellation at the foot of Orion.

Columba, or the *Dove*, is S. of the Hare.

The *Centaur* is a constellation to the S. of the Virgin, on a line with the horizon.

Lupus, or the *Wolf*, is S. of the Scorpion.

Argo to the S. of Hydra.

Antinous S. of the Eagle.

Equuleus, or the *Little Horse*, between the Dolphin, Aquarius, and Pegasus.

The *Great* and *Little Triangle*, with the *Northern Fly*, are in the centre, between a star of the second magnitude in Andromeda, and the Pleiades.

Eridanus, or the *River*, is between Rigel in the foot of Orion, and the Whale.

Charles's Heart to the S. of the tail of the Great Bear.

Berenice's Hair between the Great Bear and the Lion.

The *Lynx* between the Twins, the Great Bear, and the Waggoner.

The *Unicorn*, to the S. of Procyon, between Orion and Hydra.

Leo Minor to the N. of the Lion.

The *Sextant* to the S. of the Lion.

Lacerta, or the *Lizard*, between the Swan and Andromeda.

The *Rein-deer*, and the *Camelopardalus* between the Great Bear and Cassiopeia.

Canes Venatici, or the *Greyhounds*, between the tail of the Great Bear and Bootes.

Vulpes and *Anser*, or the *Fox* and *Goose*, and *Sagitta*, or the *Arrow*, to the S. o. Lyra and Swan, or N. of Eagle and Dolphin.

Sir W. Herschel observed 2400 double stars. South and J. Herschel 380. South, since, 458; and Herschel, since, 1000. The Dorpat catalogue gives 3063.

Struve has catalogued 2707 double stars in 8 classes, from less than 1″ distance to 32″. He found that Comæ Berenices, 42, moves 130° in 6 years, that the period of γ Ophiuchi is under 40 years, and that μ Coronæ and ω Leonis were, in 1838, at their nearest distance.

Struve, South, and J. Herschel have increased Sir W. Herschel's catalogue of double stars to above 3000; and 30 or 40 are binary systems of moving stars. Dunlop has observed 253 in the southern hemisphere, and among them 6 Eridanus has an attendant, which moves with great velocity! The 2 stars of Cygni moved in 50 years 4″·23. One in Cassiopeiæ moves 3″·74 per annum.

Among them are numbers in which the interval is less than a second, of which ϵ Arietis, Atlas Pleiadum, γ Coronæ, η Coronæ, η and ζ Herculis, and τ and λ Ophiuchi, may be cited as instances. They are classed according to distances, the nearest forming the first class. Systems are *imagined*, composed of two stars revolving about each other in regular orbits, and constituting what are termed *binary stars*. Among the more conspicuous are—Castor, γ Virginis, ξ Ursæ, 70 Ophiuchi, σ and η Coronæ, ξ Bootis, η Cassiopeiæ, γ Leonis, ζ Herculis, δ Cygni, μ Bootis, ϵ 4 and ϵ 5 Lyræ, γ Ophiuchi, μ Draconis, and ξ Aquarii, and are remarkable instances of observed motion. To some of them even periodic times of revolution are assigned. The revolution of Castor is set down at 334 years, γ Virginis at 708 years, and γ Leonis at 1200 years. The number of double stars possessing this character is between 30 and 40: but, be it observed, they are called double merely by assumption. They are in the same visual line, but may be billions of miles in distance asunder.

The most remarkable is γ Virginis. It is of the fourth magnitude, and its companion is almost equal.

η Coronæ has made a complete revolution since its first discovery by Sir William Herschel, and is far advanced in its second period. ξ Ursæ, ζ Cancri, and 70 Ophiuchi, have accomplished parts of their orbits.

Sir John Herschel, in four years at the Cape, made observations on 1232 nebulæ and clusters, and on 1192 double stars with his 20-feet reflector. He also made micrometrical measures of 407 principal double stars, and discovered 15 planetary and annular nebulæ. He especially surveyed the 2 Magellanic clouds 4 of the double stars

appeared to change places, but Robinson reasonably doubts whether these motions are physical, or optical in regard to 2 stars only in the same line. The 3 chief nebulæ are β Orionis, η Argus, and 30 Doradus.

There are *periodical stars*. *Omicron*, in *Cetus*, appears in periods of 334 days; at its greatest brightness, about 14 days, and equal to the second magnitude. It then decreases during about 3 months, till invisible, and remains so about 5 months, and again becomes visible, increasing during 3 months of its period. Nor does it always return to the same degree of brightness, nor increase and diminish alike. Between October, 1672, and December, 1676, it did not appear.

Algol, or β Persei, a star of the second magnitude, continues for 2 days 14 hours, when it suddenly diminishes in splendour, and in about 3½ hours is of the 4th magnitude. It then increases, and in 3½ hours is restored to its usual brightness, going through its changes in 2 days 20 hrs. 48 m.

χ Cygni is stated to have been scarcely visible in 1699, 1700, and 1701.

A star suddenly appeared in 125 B. C., and led Hipparchus to draw up a catalogue. Another blazed A. D. 289, near α Aquilæ, remaining for 3 weeks as bright as Venus, and then disappeared. In 945, 1264, and 1572, brilliant stars appeared between Cepheus and Cassiopeia. The star of 1572, was suddenly as bright as Sirius, and increased till it surpassed Jupiter, and was visible at mid-day; but it diminished in December, and in March 1574, entirely disappeared. In October, 1604, another star, not less brilliant, burst forth in Serpentarius, and continued 12 months.

In 1670, a star, in the head of the Swan, after becoming invisible, re-appeared, and, after undergoing fluctuations during two years, disappeared.

Omicron, in Cetus, varies twelve times in eleven years. Algol increases and decreases every sixty-nine hours. Hydra vanishes and re-appears every 494 days.

A Star of the sixth magnitude in the wing of Virgo, 42, disappeared about eight years since. Various Stars appear and disappear.

As proofs of *a solar orbit*, and of the progression of the Earth and Planets with the Sun among the Stars, in space, some Stars approach or expand in distance, and north and south; while others recede or collapse to the equator, and *vice versa* south and north. The present line of direction is exactly indicated by those which north and south the least. In fact, all the motions concur in proving that the solar system is moving *from* the Stars in the winter solstice and *to* them in the summer. The varied effects on Stars, in the same parts, as Castor and Pollux, or Aldebaran and Betelgeuse, arise chiefly from their different distances, the nearest being most affected.

Twenty-eight stars change their colours. Many of the double stars have different colours, as red and blue, and some single ones are red, blue, or white.

Bradley thought that if the parallax of a fixed star had been *one second*, he should have been able to detect it. The diameter of the Earth's orbit is, therefore, but a point at the fixed Stars.

Dr. Herschel computed the length of the *visual* ray of the telescope which he used. It reached Stars 497 times the distance of Sirius. Now Sirius cannot be nearer than 100,000 × 190,000,000 miles, therefore Dr. Herschel's telescope, at least, reached to 100,000 × 190,000,000 × 497 miles = 9941 billions miles. He saw Stars 42,000 times more distant than Sirius; and a cluster 11 trillions of miles distant.

Nebulæ abound in the region from Virgo, Coma Berenices, and the Great Bear.

The light of the Sun is 20 millions of millions greater than that of Sirius. Yet, if the annual parallax of Sirius were half-a-second, the distance would be above half a million of times the distance of the Sun, or 50 billions distant, and he would appear to us 3 7 times larger, if in the place of the Sun.

Sirius, 324 times brighter than a star of the 6th magnitude; and others, of the first, 100 times brighter; 4 of the second, and 8 of the third, are deemed equal to the first.

Wollaston estimated, that it would require 20,000 million Siriuses to afford the light of the Sun, though, from its distance, the light of Sirius must be as 14 Suns.

The velocity of the Earth and of light, occasions each Star to appear to describe a circle or line of 40″, called nutation as it is remote from, or near the Ecliptic.—*Bradley*.

Arago maintains that double Stars are proximate, or in one system; but in the distribution of millions in space, it could not be otherwise than that a given proportion, situated at various distances, would have visual rays often in union, yet at all distances. Of 120,000 in 10 degrees of S. declination, 987 are within 4 seconds; 675 others within 8; 659 within 16; and 736 within a minute of each other. At the same time, in 57 instances, the 2 are of different colours, indicating differences of distance.

There are 41,252 square degrees in the sphere of the heavens, and in the above 24,000 square degrees, Struve has catalogued 120,000; that is, 5 in a square degree; while Sir W. Herschel estimates them at several millions within the 12th magnitude. These, at their various distances, would approach in their visual rays, within every appreciable measure.

Arago and Mathieu assure themselves of the fact, that 61 *Cygni* has a parallax of *half a second*. Then, its sine being 2 425, this is to 1,000,000, as the diameter of the Earth's orbit, 186·5 millions is to the distance of 61 *Cygni*, or 77 billions of miles nearly; a distance which light would not travel in less than 13 years. By their observations, that this Star moves 5 seconds in the year, *i. e.* above 10 times the Earth's orbit diameter, or 1865 millions of miles, *i. e.* 3·2 times the velocity of the Earth. The annual parallax at half a second gives

a distance of 76,907,000,000,000 miles. Of 1 second, half; of 2 seconds, a fourth, &c.

These EXHAUSTLESS WONDERS then extend themselves to clusters, or distinct assemblages of vast systems; and to incomprehensible nebulous spaces in all forms, so as to perplex an understanding which is instructed only by the facts in our own system. That all have motions there can be no doubt, since *motion is the vital principle of all material power.*

Comets.

COMETS are moving masses of transparent fluids or vapours, which descend from high angles of 40 to 85 degrees towards the plane of maximum solar force; and are there turned by that force into another line of motion like an orbit. They are estimated at many thousands in number. Their popular characteristic is the stream of light which is directed from them in opposition to the relative place of the Sun; just such as a glass globe of water would present on the side contrary to a strong light. Telescopic stars of the 15th magnitude have been seen through their centres. Like all pellucid bodies, they retain little heat, and, perhaps, have not more in perihelion than would liquify them; while, in passing to their aphelia, they would be crystallized, or if gaseous be condensed. As far as identified, the appearances of the same comet greatly vary. Increasing rotation as they approach the solar plane of equatorial force, and decreasing rotation in aphelia, would explain nearly the whole of their orbit phenomena; but we must await the age, when forces and motions are recognized as causes, instead of causes created by human imagination, before we can clearly understand the *sui generis* mechanism of Comets.

137 Comets have entered the solar system with declinations from 80° to 90°, 88 from 70 to 80; 79 from 60 to 70; 63 from 50 to 60; 81 from 40 to 50, and only 90 below 40°. Only 24 have passed between Mercury and the Sun, 47 within Venus, and 58 between Venus and the Earth's orbit, and 73 between the Earth and Mars. The rest between Mars and Jupiter's orbits. Their orbits seem to be deflected or bent, when they arrive at the *plane* of the zodiac.

Comets are chiefly remarkable for a luminous projection in a line directly opposite to the Sun, which therefore follows them as they approach the Sun, and goes before them as they leave the Sun, and is a head or tail as their positions vary; but by the vulgar, this luminous projection is always called a tail. Comets have very large atmospheres, and Herschel thinks some of them are all atmosphere. Of course, then, the Sun's rays pass through the spherical atmosphere, just like light through a glass globe, and the projection increases in length as it approaches the luminous Sun. When a Comet has a distinct nucleus, the projection is divided in the middle by a sensible line, as that of 1811; these projections are some millions of miles long, some even 80 or 150 millions.

Hevelius and Dorfel first explained that the orbits of Comets were parabolic with the Sun in the centre; and Halley suggested that the orbits were periodical.

Most Comets present some differences of phenomena, which disturb previous theories respecting them.

Encke's Comet, or eccentric planet is *said to have* a period of 1208 days, or 3¼ years, and to have appeared in Sept. 1819. Its inclination is 13°, and perihelion 157°, and its perihelion is within Mercury, and its aphelion beyond Jupiter.

Biela's Comet has a period of 2440 days, or 6⅔ years.

In its last appearance it was only telescopic, very dull, and so rare, that small stars were seen through its centre.

The Comet of 1811 was 10,900 miles in diameter, *i. e.* twice the bulk of the Earth, and its luminous projection 132 millions of miles. Lambert calculated that it was 17 time larger than Jupiter.

Many Comets have no nucleus, and the smallest Stars have been seen through them. In those with a nucleus, the light nebulosity is not in contact with the nucleus. In the Comet of 1811, the nebulosity was 25,000 miles, and its interior surface was 30,000 miles from the centre of the nucleus. The tail is not to be distinguished from the nebulosity on its side. The nucleus of the Comet of 1811 was 2700 miles in diameter; some are not 40 miles, and others not 500.

The tail of the Comet of 1680 was 90 degrees, or 100 millions of miles long. That of 1769, 97 degrees, and 42 millions of miles. One, in 1744, had five or six tails. No phases have been discovered in Comets.

Arago thinks that not less than seven thousand Comets revolve in our system.

The perihelion distance of the Comet of 1680 was but 150,000 miles from the Sun, with a velocity 880,000 miles an hour, while the aphelion is 2898 millions of miles, in 575 years; others are estimated to have aphelia distant from 15 000 to 66,000 millions of miles, as that of 1763, with a period of 7334 years!

Halley's Comet, in 75 years, performs an orbit 3420 millions of miles long, and 850 millions broad. Its perihelion is but 57 millions from the Sun. It passed centrally over a star of the 9th magnitude without obscuring it. Its tail increased as it approached the Sun to 30° or 40°. In August, 1835, it appeared as a dim vapour without a tail, and it increased as it approached. Luminous brushes appeared in October opposite the tail, like luminous gas.

As Newton made no observations, he derived all that he used from Flamstead; yet his behaviour to him led the latter to call him insidious, subtle, ambitious, excessively covetous of praise, and impatient of contradiction; again, Whiston says of Newton, that he was of the most fearful, cautious, and suspicious temper that he ever knew, and impatient of contradiction. Hutcheson concurs in the same opinion, and adds, overbearing arrogance, in which other writers

of the time agree. When Flamstead pointed out some errors in Newton's IVth Book, he asked rudely, why he did not hold his tongue; and at another time, called Flamstead a puppy, &c. &c. Owing to the treacherous conduct of Newton and Halley, the Government were obliged to cancel the 2d volume of the Historia Cœlestia, and a new edition was printed. Flamstead was no admirer of the gravitation system.

The Comet, which returned in October 1835, was in 1531 of a bright gold colour; 1607, dark and leaden; 1682, bright; and in 1759, dark and obscure.

Newton, to the last, taught that Comets were fuel to the Sun! The Editor would rather teach that they are germs of future planets.

The Fall of Bodies and Weight.

The most remarkable of sensible phenomena is the apparently spontaneous *motion* of an unsustained body towards the centre of the Earth; and the variations of the same principle when bodies are suspended on a balance, called weight. It is, at the same time, the force which obviously consolidates a planet into one mass.

Vulgarly viewed, it was deemed, in dark ages, a law of nature, by which bodies fell downwards; in monkish days, it was regarded as a miracle; but, in semi-dark and cloistered establishments, the names of attraction and gravitation were given to it in the 16th century, but without advancing knowledge, since no one could explain the *modus operandi* of the words employed. In our own age, Vince, for a reward given by the Bench of Bishops, in 1786, proved *in set terms*, that no mechanical agency could produce it, and, therefore, that the cause was the immediate agency of the Deity. This, however, was a rather unphilosophical way of cutting the Gordian Knot!

In the mean time, it being imagined to be proved that this force acts as the reciprocal square of the distance, for in high numbers the ratio of approximate numbers and their squares, differing but slightly, the law was adopted without regard to its cause, which on all hands was pronounced to be unknowable and inscrutable!

These difficulties, however, pervaded all books and schools before the two-fold motions were generally recognized, and, as usual, book after book, for two centuries, has adopted the current opinions.

About 1805, it occurred to Sir R. Phillips, that as the fall of bodies is a mere phenomenon of *motion* on a *moving* globe, itself subject to *two* great motions; so any variance in the direction of these would, as in all such cases, produce an *increase* of velocity in a body, surrendered to their free action; and the direction to the centre would be likely to be the constant diagonal of both. It would fill a volume to describe the difficulties which attended the developement of this simple problem, and the opposition which the attempt raised in writers and teachers, who were committed to the previous mysteries. No one had attended even to the quantities of these motions, and there was a complication in them, which, for years, baffled satisfactory conclusions.

Even to this hour there is no precision in the data. The transit means of determining the parallax gave from 9″·342 to 8″·578, whose mean 8·96 gave a distance of only 91 millions, while some exaggerators, taking it at 8·578 and 8·6, claimed 95 millions.

Nor, till Lambton's measure, could we approximate the Earth's size within 50 miles.

Even the length of the second's pendulum, and the fall of bodies, was undetermined.

However, we now have these quantities very nearly, but they have not been investigated with any view to the major problem in question! The motion of the fall of a body is not, in any school in 1839, regarded as a sequence of the Earth's two motions.

The theory of the problem is this, that while the Earth, in small times, is describing a right line with great momentum in the orbit, every part of the Earth's surface is by the rotation describing lines, which cut the orbit direction at right angles, and at every angle; while the action and reaction of the opposite sides, or antipodes of a revolving sphere render every contrary force, at every point, a common *deflective* force of the whole. In fact, the centre alone moves uniformly, and every other point and part is subject to an extra motion in the rotation, at an angle rendered common by reaction, and it is as to the orbit line a *deflection*, whether, so to speak, it is ascending or descending. Then, the usual consequences, increase of velocity and novelty of direction, attend a body subject to 2 motions in constant mean directions.

It would be a point solvable by the usual problem of the parallelogram of forces, but in this case the rotatory motion is of its own kind, that is, in 180 degrees, and not within any angle of a quadrant. If tried, it will be found to give an even 16 without the fraction, and in the last edition an example was given. The orbit force, applied to a mixed mass of varied density, would form a train, or condense it into its line of direction; and it is the best short account of the operation, that each of these effects are corrected by the other, and the resultant is such a neutralization as corrects both, and carries the whole towards the common centre of motion.

Then the circumference of the Earth 24897 Log. 4·396147 being known, and the period of rotation 86164 seconds, Log. 4·935326, we determine its mean rotative velocity to be 1525·65, Log. 3·183451 feet at the Equator. This is necessarily adopted as a convenient fundamental measure, owing to its fixed relations to the whole sphere (also in simultaneous rotation) and acting and reacting by its opposing hemispheres and quadrants. Now, in this display of force, the area of the rotated Equatorial plane is but as 1 to 4 of the whole rotated surface of the sphere, therefore, in numbers, we may express the whole *inverse* force of the sphere as 6102·6, Log. 3·785515. We can take it in squares,

if we please, and get a square result, the root of which is the very same as the relations of the lines. In comparing the area of the Equatorial plane with the area of the sphere, the object is to get *a simple ratio* of the linear measures. If 1525·65 feet express the force at the Equator, 4 times the length is the numerical force of the sphere.

It may be added from Archimedes, that the sphere, that is, 4 equators, are equal to the convex part of the circumscribing cylinder; consequently, 4 revolving equators are equal to a revolving equal cylinder, itself equal to the revolving sphere.

Taking then the mean distance at 93,370,000 and deducting from the feet in orbit, Log. 12·490882, the Log. of seconds in a year — 7·499111, we get Log. 4·991909 = 98154 feet for the direct orbit velocity per second. Then 4·991909 — 3·785515 = 1·206394 = 16·084 feet, the fall in a second. Proceeding by squares gives the same result.

Then $\frac{O}{R} = F$, or $O \times \frac{1}{R} = F$.

Thus the rotative is a proper *inverse* force, which may be expressed in relation to the direct orbit force, as $\frac{1}{6102 \cdot 6} = 0 \cdot 0001638645$. Then this fraction into the orbit force 98154, is the true velocity of fall for a second:

Orbit Force.		Inv. Rot. F.		Fall per Sec.
98154	×	·0001638645	=	16·084

For two seconds:—

$(2 \times 98154) \cdot (2 \times 0001638, \&c.) = 4 \times 16 \cdot 084$

For, as *twice* the time gives *twice* the force, so each force requires to be multiplied by 2. But, on separating the factors, it becomes $(2 \times 2) \cdot (98154 \times 0 \cdot 0001638, \&c.)$ Then, as $98154 \times 0 \cdot 0001638$, &c. is equal to 16·084, it becomes $4 \times 16 \cdot 084$.

For three seconds:—

$(3 \times 98154) \cdot (3 \times 0001638, \&c.) = 9 \times 16 \cdot 084$

For a quarter of a second:—

$(\frac{1}{4} \times 98154) \cdot (\frac{1}{4} \times 00016, \&c.) = \frac{1}{16} \times 16 \cdot 084$

For five-twelfths of a second:—

$(\frac{5}{12} \times 98154) \cdot (\frac{5}{12} \times 00016, \&c.) = \frac{25}{144} \times 16 \cdot 0799$

And so on, in any variety of whole numbers or fractions.

By adding Unity, as an increment of force, to the rotative force, we get $\frac{6102 \cdot 6 + 1}{6102 \cdot 6} = 1 \cdot 0001638645$, which, with 98154, gives 98170·084, the whole diagonal, instead of the differences as above.

We might take the mean perpendicular deflexion $\frac{1525}{1 \cdot 5708}$ instead of the circle, but the perpendicular would be 971·126 into 6·2832; and $1525 \times 4 = 971 \times 6 \cdot 2832$.

Figures have been preferred, but the principle is the same, if we take $O \times \frac{1}{R} = F$, then $(2\,O) \cdot (2 \times \frac{1}{R}) = 4\,F$, the F being as the squares of the times, because there are 2 factors, each a multiple by the times.

Proving, rigorously, that the fall of bodies is owing entirely to the 2 motions; and exemplifying Galileo's principle of acceleration in the clearest manner.

The perihelion and aphelion distances would vary weights, if not compensated, or nearly so, by varied velocity.

No other proof resembles this in the whole circle of natural philosophy; and it is of ten-fold value, because it relates to a subject so interesting, and affecting so many points. For example, since it appears that the fall of bodies, and all the phenomena of weight and weighing arise from a *local* cause depending on the *local* motions of the Earth, those phenomena can be adduced as no evidence of *universal* gravitation; and no phenomena, not involved in the Earth's *local* motions, can be ascribed to the same cause as the cause of the fall of an apple.

It is scarcely necessary to observe, that in the same sphere the same forces operate every where. The square of the sine and the cosine of any latitude give an inverse force equal to the square of the Radius or Equator; and the diagonal of every sine and cosine is a Radius directed from the circumference to the centre.

The inverse force is, however, less at the Poles of an oblate spheroid, because the square of the diminished sines is too little. Hence the results are greater, and 16·04 feet is more and more in proceeding from the Equator to the Poles. This is the reason of increased weight, increased pendulum, and increased fall at the Poles. Every thing harmonizes in a true theory, and nature is always simple and consistent.

The obliquity does not affect the results, because in the rotation, opposite sides act and react, and if one is south the other is north, and their different forces neutralize each other.

Distance of the Sun by Motion.

The distance of the Earth from the Sun, taking the mean fall of a body at 16,084 feet, as determined by pendulums is thus found:

Log. of 16·084 fall............		1·206394
Log. of 6102·6 (4 × 1525 65) *i. e.* 4 times Equ. Rot. per sec.		3·785515
=(Orbit velocity per sec. 4 991909)		
Seconds in a year		7·499111
*Feet in orbit.............. =		12·491020
Feet in a mile....	3·722634	
Circle to Radius..	0.798180	
		4·520814
Dist. in miles 93·37 millions ..		7 970206
*Sec. in 360 deg. in orbit		6·112606
Feet in a sec. of deg.		6 378415
Feet in Earth's Radius		7·320549
Parallax 8″75234.......... =		0·942134

No unprejudiced person, who views the steps of these determinations, will hesitate to admit that this is the most simple

and satisfactory display of consecutive motions, arriving at a desirable and sublime result, that ever was performed by arithmetic. Nothing is forced, and all the numbers are authorised by modern science.

Then, as the only variable in the whole is the first line, and as there are different determinations of that quantity, we have taken it for various quantities from 16·0697 to 16·095, thus—

16·0697	=	1·206008	diff.	286—
16·07	=	1·206016	diff.	278—
16·075	=	1·206151	diff.	243—
16·08	=	1·206286	diff.	108—
16·084	=	1·206391	diff.	0
16·0875	=	1·206489	diff.	95+
16·09	=	1·206556	diff.	162+
16·095	=	1·206691	diff.	297+

Then either of these diff. + or − 7·970206, or of ·942134, gives the log. of the Sun's distance, and parallax for that fall per sec.

This, with the method of determining the fall of bodies by the two motions, renders the sublime system of consecutive motions complete. The Author bequeaths them as a legacy to posterity!

The observers of the transits at different places, make the Earth's parallax from 8″·578 to 9″·343, a difference of 0·765, and every 10th of a second is 1,130,000 miles.

Sundry authorities state that the fall of a body in a second, at the equator, is 16·0463 feet; in middle latitudes, 16·084; at London, 16·0951; and in Spitzbergen, 16·1264; the mean of the 4 being 16·088. The respective pendulums are 39·02, 39·114, 39·13908, and 39·2164.

The mechanical methods are proved by multiplying the Earth's circumference into the number of rotations in a sidereal or complete revolution, into the ratio of the orbit and rotatory motions for the orbit, and dividing for the Radius.

Log. circum. 24 897 miles....	4·396147
Sidereal rotations 336 256....	2·563785
98123 ÷ 1525 649 $\left(\frac{O}{R}\right)$	1·808454
Orbit in miles	8·768386
Ratio to Radius 6·2832	0·798180
Distance 93,370,000 = ...	7·970206

Airey makes the parallax 8″·6919, which gives a mean distance of 93,937,000 miles.

Kepler's Law.

The DISTANCES of THE PLANETS from the Sun are deduced from Kepler's ratio, between the Times and Distances. The Earth was taken as the standard, or T & D, and it was promulgated that

$$\text{As } T^2 : t^2 :: D^3 : d^3$$

which may be varied with the same value

$$\text{As } T : t :: D^{1\cdot5} : d^{1\cdot5}$$

$$\text{or, As } T^{\frac{2}{3}} : t^{\frac{2}{3}} : \cdot D : d.$$

The simple ratio of the Times and Distances T : t :: D : d, gives d too much; proving that the ratio of T to t is too high. The excess proves, that T and t require to be expressed in the square of their cube-root; or D and d raised to the 1·5th power.

In the case of Mars and the Earth, by which Kepler operated, the natural ratios of the times and distances are:—

Log. of ♂'s time	2·836944
Log. of ⊕'s time	2·562598
Ratio of times 1·8808 =	0·274346

Then taking the relative distances.

Log. of ♂'s dist.	8·154277
Log. of ⊕'s dist.	7·971381
Ratio of dist. 1·5237 =	0·182896

It is plain, therefore, that in a proportion of the simple Times and Distances, the ratio of the times carried to the distances, would give an excess in the last term of 0·091450, or, the 1·2344th. That is, it would make ♂'s distance 8·154277 + 0·091450 = 8·245727 = 176 millions, or 34 millions too much.

Let us take the second proportion $T^{\frac{2}{3}}$. Then the ⅔ root is obtained by dividing the Logs. of the times by 3, and multiplying by 2. Then this is the same ratio that the times are required to be, to accord with the distance.

Consequently $T^{\frac{2}{3}} : t^{\frac{2}{3}} :: D : d$.

But, if we prefer $D^{1\cdot5}$ to $d^{1\cdot5}$, then we add its square-root, or half the Log. for the 1·5 power.

2)	8·154277	
	4·077139	
	12·231416	$d^{1\cdot5}$
And	11·957071	$D^{1\cdot5}$

1·8808 = 0·274345 = Ratio of $D^{1\cdot5}$: to $d^{1\cdot5}$

So that $T^{\frac{2}{3}} : t^{\frac{2}{3}}$ is as the ratio of the Distances; or $D^{1\cdot5} : d^{1\cdot5}$ is as the ratio of the Times; and either will produce the same, and the desired result = d = 142,623,000, as the true distance of Mars.

In the working of Kepler's formula. T and D in the Earth being constant. so $\frac{D^{1\cdot5}}{T}$ gives a constant 9·394473, which, added to the log. of the Time of any Planet, the sum is equal to the 1·5th power of its distance, found by substracting 1·3d of the addition. For Mars

$D^{1\cdot5}$	=	11·957071
—T	=	2·562598
Constant		9·394473
+ t ♂	=	2·836945
$d^{1\cdot5}$	=	12·231418
— ⅓		4·077139

Mars' distance 8·154277 = 142,650,000 miles.

This is so new and instructive, that it may be repeated as to VENUS.

⊕ Time	2·562598
♀ Time	2·351603
Difference	0·210995
— 2·3ds	0·140663
⊕ Distance	7·971381
♀ Distance	7·830718 = 67,720,000 miles.

Kepler found that the ratios of the times and the distances failed in Mars and the Earth; and he then approximated by taking the cube-root of the square of the times, which expanded, became $T^2 : t^2 :: D^3 : d^3$!

To understand the necessity of diminishing the ratio of the Times by 0·091448, or increasing that of the Distances by 0·091448, we must bear in mind that the radii of Curvature, in 2 concentric planets, varies those Forces which vary the Times; and, in comparing 2 in time and in distance, we must take their mean Curvature as an element of their relative force. Then the Curvature is as the radii or distances, in ♂ and ⊕, or 0·182896, and the mean or square-root is 0·091448, which, added to the ratio of the Distances,—or subtracted from the Time's ratio, produces a ratio of equality.

There is, therefore, no necessity for resorting to Kepler's law; for, in a simple ratio of Times and Distances, if we deduct from the last term the square-root, or mean, of the two Curvatures, we get the true Distance. But, as one of the Distances is not supposed to be known, it appears that the cube-root of the ratio of the Times is its equal, and may be used instead.

It will be observed, that this mean Curvature ·091448 is equal to the cube-root of the ratio of the Times, in this case ·274346 by 3; or, it is the square-root of the ratio of the Distances, in this case ·182896 by 2.

Hence, instead of a subduplicate law diminishing the forces as the square of the distance, it appears that compensation, even for increased simple distances, is afforded by such an enlargement of the times and decrease of velocity, as accords with the mean ratio of the curvature or distance of any two compared planets. In other words, the square-root of the ratio of the distances, or the cube-root of the ratio of the times, taken from the ratio of the times, renders the simple proportion of the times and distances equal in ratio, and accordant with fact. Hence, on this principle, as well as that of *equal* common action in the Sun, and *equal* special reaction in all the Planets, the forces are necessarily equal *throughout*, and it would be a strange *hotch-potch* if different degrees of force prevailed in different parts of *one system*. Harmony resulting in Infinity, and Infinity commanding Harmony, are the necessary features of a perfect material Universe.

The subject is susceptible of much amusing amplification, but thus far the Editor hopes his analysis will be received as the first legitimate demonstration of Kepler's mystified law, or hieroglyphical paradox.

Examples may be given in the Planets.

The Earth's Distance (D) 7·971381
Time (T) .... 2·562598
Mars' Time (t).......... 2·836944

Then a proportion of these T : t :: D : d gives 8·245727 = 176,100,000, or 33 too much.

But, deduct half the Log. of the mean Curvature 0·091448, and we get 8·154290, Mars' true distance = 142,623,000.

Or, take the —1·5 or 0·666 or ⅔ roots of the Times. ⊕ 1·708397 and ♂ 1·891296, instead of the Times, and as the first and second terms of the proportion, their difference ·182899 added to 7·971381 gives 8·154290, Mars' true distance as above.

In JUPITER the time is 3·636746 as the second term, then this into the third 7·97138, and the first 2·562598 deducted gives 9·045529, or 1110½ millions, far too much.

But taking, for brevity, the cube-root of the difference of the Times, we get 0·358049 for the square-root of the 2 curvatures, and this deducted from 9·045529 gives 8·687170 = 486,933,333, Jupiter's Distance.

As to ♂, the radius of Curvature in the ⊕ employs 1·2344 more force. In ♃ and the Earth, 2·28, but in Venus the curvature is 1·1758 more than the Earth. These, then, were Kepler's $T^{\frac{2}{3}}$ and $t^{\frac{2}{3}}$ exactly.

In practice, we may shorten by using the constant 7·971381 — 1·708397 = 6·262984, to be added to the ⅔ root of the Times.

Thus, in MERCURY, the Time is 1·944333. Then ⅔rds, or the square of the cube-root of this is 1·296221, which, added to the Earth's Constant, is 36,241,400 for ☿ distance.

So SATURN's Time is Log. 4·031781, two-thirds of which is 2·687854, which, added to the Constant 6·262984, gives 8·950838 = 892,972,000, ♄'s Distance.

Then HERSCHEL's Time is Log. 4·486951 and two-thirds, as 2·991301, which, added to 6·262984, gives 9·254285 = 1,795,900,000 for Herschel's Distance.

So that, except the puny asteroids which lie midway between Mars and Jupiter, we have the whole as under:—

Days.	Log. Time.	Dist. M.M.	Log Dist.
☿ 87·969	1·944332	36·21	7·559205
♀ 224·7	2·351603	67·72	7·830718
⊕ 365·256	2·562598	93·63	7·971381
♂ 686·979	2·836944	142·62	8·154290
♃ 4332·58	3·636746	486·93	8·687470
♄ 10759·2	4·031781	892·97	6·950838
♅ 30686·8	4·486951	1795·9	9·254285

Of course, the Distances are only approximations, since they must be varied by bulks, satellites, &c.

Kepler's second law, that equal areas are generated in equal times, is a truism perfectly accordant with a system of equal momenta in the Planets, and the equality of force acting and re-acting. The force is constant in the same time which enables a Planet to generate any area, and if the sides of the triangle are lengthened the base or orbit is diminished, and *vice-versa*. It is a proof of the equal re-action of equal spaces, and that space is filled with a medium.

The Sun.

The Sun, the prime mover of what is to us a vast system, and the illuminator and vivifier of a space several thousand millions

of miles around, is a body little understood from the want of analogies. It is true, that all the stars, from their distance and brightness, must also perform the same offices on spheres of equal dimensions, but our knowledge of them is, of course, less than that of our own Sun. In bulk, it is one million 385 thousand times larger than our globe; and hence, its command over the planets of its own system, which it governs by a motion of its centre round a centre of their combined momenta. This motion is, of course, contrary to their motions on the general principle of equal action and reaction; and while the reciprocity, in establishing *equal* distances, confers motions necessarily circular. But a still more extraordinary property of the Sun is its constant light and heat, which, from what we know of those phenomena, in the combination of oxygen with evolved hydrogen, points to the same cause. It proves, that those elements are universally diffused, and the connection with the Sun's known motion through space indicates that it thus obtains its constant supply of oxygen. The protrusion of light then indicates the presence of a medium of continuity. It is not electrical, because electrical action implies separation and reunion with force; but is simple combustion, such as we witness in our own fires. It is like a volume of gas, or atmosphere of carburetted hydrogen, from a magazine of hydrogen and constant supply of oxygen.

Herschel and others believe they have seen the solid nucleus through openings of this atmosphere.

Great motion of progression, rotation, and revolution around the orbit of momenta, may be considered as the exciting cause of ignition. Solar theories were mostly written before the discovery of oxygen and hydrogen; and, hence, are beset by imaginations about caloric and other fancies. The identity of solar and terrestrial light were not admitted till the invention of the gas blowpipe, and the combustion of lime. Others have mixed up theories of superstitious chimeras, and regarded the Sun as the theological Heaven and Hell, and Newton believed that the fire required replenishing by the substance of comets, while others have calculated the rate of decrease from the emission of light, considering light as an entity, not an effect. Atomic action and reaction on the surface of a planet, with reflections and reiterations in vallies, are the chief causes of the heat derived from the Sun, since under the tropics the tops of mountains are perpetually congealed. That the motions of the Planetary System are entirely derived from the solar motion, is proved by the fact, that their mean motions correspond exactly with the plane of the solar equator, and the breadth of the planetary zodiac is taken at 7½ degrees on each side of the solar equator, while 7½ degrees is the inclination of its pole. The two vast hemispheres above and below, seem to be the region for the range of Comets.

Herschel supposes the spots in the Sun are mountains on its surface above 300 miles high. On examining the Sun with several powers from 90 to 500, the black spots seemed the opaque ground or body of the Sun; and the luminous part an atmosphere, intercepted or broken. If one of the spots appears upon the eastern limb or edge of the Sun's disc, it moves thence to the western edge in 13½ days; it then disappears, and, in about 13½ days more, is seen again upon the eastern edge; and so continues, completing its revolution in about 27 days.

The Sun's diameter on Jan. 1, is 32′ 35″·6; on Feb. 1, 32′ 30″; March 1, is 32′ 18″·2; April 1, 32′ 1″·4; May 1, 31′ 45″·8; June 1, is 31′ 34″·2; July 1 & 7, is 31′ 31″·4: the Aphelion. It then increases to the perihelion, Jan. 1. The difference is 1′ 4″·2.

The diameter of the Sun is 883,246 miles and the circumference 2,774,800. The diameter is 111½ that of the Earth, and it is equal to 1,384,472 Earths.

In 1779, Herschel measured a spot in the Sun 50,000 miles in diameter. These spots cross the Sun from east to west, and shew that the axis is inclined 3° 45′ to the eastward. Spots have been seen to divide and separate in many parts. They frequently make notches in the Sun's limb. When they disappear, they are succeeded by faculæ or bright spots. They are classed as openings, shallows, ridges, nodules, corrugations, indentations, and pores.

The Sun's axis, inclined 7¼ to our Ecliptic, points to the space midway between the Polar Star and Lyra.

Owing to the simultaneous motion of the Earth, the real rotation of the Sun is 25 d. 9 h. 56 m.

The angular velocities of the Sun are as the squares of the apparent diameters, and the diameters are inversely as the distances. Therefore, the products of the velocity by the square of the distance is always equal. This variable distance is the radius vector.

The angular velocity of the Sun is greatest, or 61′ 9″·9 per day, when its visual diameter is greatest, or 32′ 35″·6, and it is nearest on Dec. 31. And the velocity 57′ 11″ 5, is least when the visual angle, 31′ 31″, shows that it is farthest off. Taking the mean distance as 100,000, the greatest is 101,679, and the least 98,321. The velocities as a mean of 100,000, are as 103,386, and 96,614, or twice as great a difference as in visual size. Herschel, the younger, infers, from the fact of the Sun having the greatest visual angle, when the greatest angular motion, and the least angle when the least, that the daily motions are inversely as the squares of the distances, or in a conic section, but this is a mistake. The distances are inversely as the angles of vision. Thus, 61 99 into 31 31 is 694; and 57·115 into 32·35·6 is 671·1, and this is the exact *ratio* of the simple aphelion and perihelion distances. Then, 671·1 into 1·03421, the ratio of the angles, is 694 exactly, proving a law of the distances only!

Nothing can be more irrational than the hypothesis of a *fixed* Sun governing a *moving*

system; nothing more trifling than the connection of the motions with planes of conic sections; nothing more absurd than a law for one of the bodies which does not obtain equally in the other, and, therefore, no appreciable law as to either; and nothing can be more incongruous than the hypothesis that the local generation of central force, as a necessary principle of aggregation in one planet, governs distant bodies, not involved in the same motion, as a *universal* force.

Herschel conceived the Sun and Planets to have *a general motion*, with relation to the fixed Stars, at the rate of the Earth's motion in its orbit; and at this rate, if the distance of the Stars is 200,000 times that of the diameter of the Earth's orbit, the Sun would be 60,000 years in moving over the distance of the nearest star, if itself fixed. Herschel, Klugel, and Prevost consider the Sun as progressing towards the northern crown, or in a line 30° inclined to our zodiac; and of this there can be no doubt.

Assuming that the central force of bodies at the Sun is equal to that at the Earth, that is, 16·084 feet per second, then, as the orbit velocity of the Earth is the central force into 4 times the rotation, we are enabled to approximate the Sun's velocity. Its rotation by the spots is 429,500 feet, or 81,315 miles per second, log. 1·910329; consequently, this motion into the seconds of time in a year (log. 7·499111) is 2,567,100,000 miles through space.

Then, taking the ecliptic angle between the sidereal and anomalistic year at 61·584—54·615=6″·969, as *the Stellar Parallax* of the Sun's line of motion, we get 6″·969×4·85 the sine of 1 second = 33″·8 or $\frac{33\cdot8}{1000000} = \frac{1}{29586}$, then 29586 × solar motion for a year, gives log. 13·890526 or 76 billions of miles, nearly, for the mean distance of the stars; at the same time, this agrees with an alledged parallax of the Earth's orbit of ¼ of a second, which gives 76¼ billions.

The Sun's R. Ascension, on Jan. 1, is 18 hrs. 44 min. 18 sec.; Feb. 1, 20 hrs. 56 min. 47 sec.; March 1, 22 hrs. 49 min. 50 sec.; April 1, 10 hrs. 43 min. 22 sec.; May 1, 2 hrs. 34 min. 40 sec.; June 1, 4 hrs. 37 min. 28 sec.; July 1, 6 hrs. 41 min. 43 sec.; Aug. 1, 8 hrs. 46 min. 28 sec.; Sept. 1, 10 hrs. 42 min. 29 sec.; Oct. 1, 12 hrs. 30 min. 33 sec.; Nov. 1, 14 hrs. 26 min. 56 sec.; Dec. 1, 16 hrs. 30 min. 52 sec. a trifle more or less.

The Sun's declination for Jan. 1, is 23 deg. 4 min. *South*; Feb. 1, 17 deg. 17 min.; March 1, 7 deg. 27 min.; April 1, 4 deg. 40 min. *North*; May 1, 15 deg. 10 min.; June 1, 22 deg. 5 min.; June 21, 23 deg. 27 min. 37 sec.; July 1, 23 deg. 8 min.; Aug. 1, 18 deg.; Sept. 1, 8 deg. 12 min.; Oct. 1, 3 deg. 18 sec. *South*; Nov. 1, 14 deg. 33 min.; Dec. 1, 21 deg. 53 min.; Dec. 21, 23 deg. 27 min. 36 sec.

The zodiacal light is ascribed to the solar atmosphere, and to its condensation in the plane of the zodiac.

As the ecliptic limits of the Sun are 30°, there must be two eclipses of the Sun every year; but, as the ecliptic limits of the moon are but 23°, there may be no eclipse of the Moon within a year.

The Sun enters Aries ♈ March 21; Taurus ♉ April 20; Gemini ♊ May 21; Cancer ♋ June 21; Leo ♌ July 23; Virgo ♍ Aug. 23; Libra ♎ Sept. 22; Scorpio ♏ Oct. 23; Sagitarius ♐ Nov. 22; Capricorn ♑ Dec. 21; Aquarius ♒ Jan. 21; Pisces ♓ Feb. 19, half a day different.

The Earth's shadow extends to the point where the apparent diameters of the Sun and Earth would be equal. The Sun's is 1918·1 sec., and the Earth's 6908·3 sec., that is, 1 to 3·6, or 3·6 times the Moon's distance; so that the breadth is 2-3ds the Moon's diameter. The Penumbra is the partial shadow at different parts of the Moon's, just as we see with one eye at a time from different points of the face.

There will be considerable eclipses of the Sun, July 18, 1841; Oct 9, 1847; March 15, 1858; Feb. 23, 1868; Dec. 22, 1870; Aug. 19, 1887, and Aug. 9, 1896.

During a total eclipse of the Sun, light is derived from the reflection from parts of the atmosphere where it is not total.

A digit is the 12th part of the diameter of the Sun or Moon.

The Moon.

The Moon, so near us, and yet so little known, proves our incompetency to soar beyond the limits of our combined senses. Maps of the surface 200 years old, and Russell's Lunar Globe prove that the surface undergoes no change. She can have no water on the side next the Earth, or clouds would obscure her ground plan. She is, in truth, regarded as a dry calx. Her reaction, however, produces a terro-lunar orbit, inversely as the masses, and this orbit scollops the orbit round the Sun produced by the fulcrum, or centre of their momenta. As to the Earth's centre, it is an oscillation to which the mobile oceans respond, and hence the tides. The Egyptians had a tradition that time was when there was no Moon. We are, therefore, to suppose, that in moving through space, in a direction *contrary* to the Earth, a mutual reaction was established in large and small orbits, like those which constitute the general scheme of the Universe.

The dark parts are not supposed to be water, while the high parts are ridges of mountains or high lands. The brilliant spots are hollows surrounded with high ridges, with a hill in their centre. This rough surface is considered as volcanic; but combustion bespeaks an atmosphere, and observations on the horns prove that there is one mountain 1-3d of a mile high, and another a mile higher.

Many Maps have been made of the Moon, and Ricciolus and Hevelius assigned names to the several parts, with latitude and longitude taken from lines drawn through the centre. One annular ridge, with a small

central rock just south-west of the centre, is called, by one, Hipparchus, and, by the other, Olympus. A large spot, just south-east of the centre, is called Ptolomeus by one, and Mount Sipylus by the other. 10° 43 east and 43° south, is the deep brilliant cavity called Tycho, or Mount Sinai, the centre of all the radiations in the south.

By Herschel's observations, we learn that the altitude of the lunar mountains has been much exaggerated. The rock, situated near *Lacus Niger*, is about one mile high; but none of the others are more than half.

Bailey and others, in observing the annular Eclipse of May, 1836, near the central path, observed such an optical, though peculiar protrusion in the Moon's limb on approaching and leaving the Sun, as led to the conclusion that it must have been produced by an atmosphere.

The coldness of the Moon's light is known, but not measured, except by gardeners. The heating rays are supposed to be absorbed.

To find the Moon's distance we take a mean parallax of 57′ 40″.

As the sine of 57′ 40	8·22453
Is to radius	10·00000
So is 3956·2 Earth's radius ..	3·59728
	13·59728
	8·22453
236,000 miles, Moons' distance	5·37275

But, as the natural sine of the mean parallax is 1678, and of 61′ 27″ the greatest is 1782, and of 53′ 53″ the least is 1569, the distances vary as 1678, 1782, and 1569.

By simultaneous observations at Berlin and the Cape, the mean parallax of the Moon was found to be 3459″, and the mean distance 237,360. In Apogee it is 252,600 miles distant, and in Perigee only 222,400.

The mean motion of the Moon is 13° 10′ per day. From New Moon to New Moon is 29 days 12 hours 44 min. 3 sec., and in a circle from Star to Star is 27 days 7 hours 43 min. 11¼, or 4½ sec.

The seconds of time in a lunar orbit, from star to star, are 2360591·5.

The ratio of the sidereal to the synodical lunation is 1 to 1·080847.

From New Moon to New Moon the exact interval in days is 29·5305887; and the period from star to star is 27·32166 days.

The mean eccentricity is 12,985 miles.

The Moon adds its inclination 5 deg. 8 min. 48 sec. to the obliquity of the Ecliptic, when the two ascending nodes coincide, and has then 28½ deg. of declination.

When the Moon is in Perigee, the angle of the Earth at the Moon (the half of which is the horizontal parallax) is 122 min. 54 sec. and when in Apogee only 107 min. 06 sec., the mean of which is 115 min. and the Hor. Par. 57 min. 30 sec.

As there are 235 lunations, or New Moons, in 19 years, within 1½ hour, the phenomena recur. 12 lunations are 354 days 8 hours 48 min. and 36 sec. The hour and half is a day in 16 cycles, or 300 years.

The nutation of the Earth's axis, created by the lunar orbit, is 18·5 sec. in one diameter, and 13·74 sec. in the other, and is perfected in 19 years, depending on the nodes.

The Moon's nodes fall back 1°·4275 per sidereal lunation, and her major axis advances 3° in 27·32166 days.

The revolutions of the Moon and the node are as 223 to 19, so that in every 19 years the Eclipses are repeated.

The Earth and Moon are exact cases of reciprocal orbits, with equal matter and motion in each body. The Moon moves 3330·7 feet per second, in its orbit, with a mass as 1, and the Earth moves 66·9 feet in its terro-lunar orbit (parallax 10·67 sec.) with a mass as 49·6274. Then 3330·7 × 1 = 66·9 × 49·6274. Again, the two sides of the diagonal, or Moon's orbit, are 2355·2 each; and the two sides of the Earth's terro-lunar orbit (66·9) are 47·438. Then 2355·2 × 1 = 47·438 × 49·274; demonstrative of a perfect equality of mutual action and reaction, and fatal to the subduplicate law.

The motions of the Earth and Moon exactly accord at equal density, and one would blush for any theory which sought to accommodate itself by assuming a difference. La Place, in a false theory of the tides, imagined the density of the Earth to be to that of the Moon as 72 to 49! But the masses at equal density, 49 to 1, exactly accord with the reciprocal motions and forces.

It is exactly the same as to the Earth and Moon, as in regard to the Earth and Sun in rotation and in precession and apsides. It gains one circumference by going round the Earth, and the falling back of its nodes and the advance of its major axis exactly accord.

The falling back of the Moon's nodes, or the advance of the ecliptic, with reference to the nodes 1°·4275 per lunation, and the total advance of the ecliptic and apsides 3°, arise from the Moon turning one circumference while going round her orbit, equal to 1°·638; the first advance being relative to her nodes only; but the 1·4275 added to 1·638 make 3°·0655 of advance in the ecliptic, the ·0655 being absorbed by obliquity.

The Moon's motions are accelerated 11 seconds in a century; and in remote centuries as 11 × by the square of the number. Hence, an eclipse 2000 years ago requires 20 × 20 × 11 seconds of time to be allowed or 1¼ hour nearly.

The inclination of the Moon's orbit is 5° 8 min. 47·9 sec.; and its eccentricity 0·054844 —Her axis is inclined to her orbit 88° 17 m.

The Chaldean period of 223 lunations, or 18 years 11 days 7 hours 42 minutes, brings the Moon within 28 min. 10 sec. of the same position again as to nodes and longitude; but 6890, or 557 years, 172 days, brings her within 1 min. 41 sec., and then all her phenomena, eclipses, &c. &c. re-occur.

The Moon's nodes or equinoxes go round the ecliptic in 6793·39 days.

The revolution of her line of apsides is in 3232·575 days.

The Moon is 24 minutes longer in performing her orbit, when the Earth is in its perihelion than its aphelion.

In the Earth and Moon, one of the two forces, the central is the common progression in the Earth's orbit. The other force, the tangential, is the exact product of the Earth's reciprocating motion in its terrolunar orbit into its mass.

The enlargement of the light part of the Moon, and the enlargement in the horizon, are optical illusions—one owing to bright objects enlarging pencils of light, and the other owing to the mind placing the Moon at a greater distance—angle the same.

The Nutation is a nodding, or swinging, of the Poles, like that which takes place during the spinning of a top. It accords in time with the rotation of the Moon's nodes, 19 years, and its quantity varies between 18″·5 and 13″·74.

Herschel and Kater believed that they had discriminated volcanoes in the Moon; and if so they indicate many circumstances relative to the internal structure, atmosphere, &c.

Newton tried to prove his sub-duplicate law by asserting that the Moon falls 16 feet in a minute, but Sir Richard Phillips contends that the Moon falls *equally* from the tangent of her orbit, in *all parts* of it; and that, in every quadrant, she falls from any tangent at an assumed apex, a quantity equal to the radius or distance, and a *proportionate* part in every minute of time. If she fell but 16 feet in a minute, a lunation would last 597 years, since her mean motion is about 200,100 feet in a minute, or 40 miles. Dividing, however, the feet in the radius, or distance, by the minutes, during which the Moon falls *equally* from every point of her orbit, the mean fall, per minute, is 127,225 feet :—

Log. of radius	5·374778
Feet in a mile	3·722634
Feet in distance, or fall	9·097382
Minutes in a quarter	3·992809
127225 feet per minute	5·104573

The mistake appears to have arisen from taking on *paper* the crown of an arch where the curvature is rapidly *vanishing*. Even if relevant, the versed sine does not vary with the law of falling bodies, and, therefore, if it *happened* to agree for a minute, it would not agree for a second or for two minutes. And whether a degree of the Earth is 1 or 2 miles more or less, per Norwood or Picart, would not make a difference of the 100,000th part!

The Moon's orbit is produced by the common motion through space, and by re-action of the Earth on the medium of space. The Sun's action on both is directed to the centre of their mutual momenta or fulcrum.

When the new Moon is within 18° of the node, there is an eclipse of the Sun; and when the full Moon is within 12° of the node, she will pass in the Earth's shadow, and be eclipsed. According to Séjour, an eclipse of the Sun can never be annular longer than 12 min. 24 sec., nor total longer than 7 min. 58 sec., and the duration cannot exceed two hours.

The height of the Earth's shadow is from 800,000 to more than a million of miles. The Moon's shadow extends from 225 to 240,000 miles, and therefore does not always reach the Earth, and never exceeds 180 miles in diameter. But the lateral penumbra extends partially to great distances.

The Moon's penumbra, in a central eclipse, will not cover the Earth's whole disc. The semi-diameter of the penumbra being equal to the sum of the apparent semi-diameters of the Sun and Moon, that is, about 16 min. 23 sec. + 15 min. 37 sec., or 32 min. at the medium, its diameter is about 64 min., whereas the diameter of the Earth's disc is about 120 min. The Moon's shadow is 60¼ semi-diameters of the Earth high. The semi-diameter of the Earth is to that of the Moon nearly as 100 to 28, and the height of the Earth's shadow is about 217 semi-diameters of the Earth; hence, the height o the Moon's shadow is equal to about 60¼ semi-diameters of the Earth; for 100 : 28 : : 217 : 60¼ nearly.

The breadth of the Earth's shadow, at the Moon, is about 3 times the Moon's diameter.

The Moon's orbit in the plane of the ecliptic, from conjunction to conjunction, is exactly equal to the orbit motion of the Earth for one solar day, or to 64·336 circumferences of the Earth.

The synodical orbit in her own plane, inclined 5° 8 min. 48 sec., is 1·609500 miles, which, by 1·00406 for inclination, is 1·602619, the daily orbit motion of the Earth.

The Earth's daily motion into 1·00406 for inclination directly, and 1·080847 for days inversely, is equal to the sidereal orbit 1,489,126 miles; and 64·336 circumferences into 1·00406 directly, and 1·080847 inversely, is 59·83 circumferences; and then, as radii are as circumferences, so 59·83 radii of the Earth (3962·8095) are equal to the orbit radius or distance of the Moon.

The periodical time of the Moon, in a lunation, is directly as the diameter of the Earth into the Earth's velocity; and inversely as the orbit of the Moon taken in the plane of the ecliptic,

$$\frac{\text{Diam.} \times \text{O}}{\text{Moon's orbit}} = \text{Moon's Time.}$$

Owing to the Moon's libration in latitude, we sometimes see one pole, and then the other. By the libration in longitude, more of the western limb is at times seen; and, at other times, more of the eastern.

The harvest Moon arises from the varied angle of the ecliptic with the horizon, so that the Moon rises several days within nearly an hour. In 1839 and 1857 there will be striking harvest Moons.

The Moon's inequalities are 6. The elliptic inequality—the annual equation—the parallactic inequality—the progression of the perigee—its irregularities—and the variation of the eccentricity.

The velocity of the Moon is in the lunar

orbit the $\frac{1}{29 \cdot 53}$ that of the Earth and Moon in the solar orbit, increased by the inclination, *i. e.* 3330 7; and the force of the Earth is to that of the Moon as 49·109 to 29 53; the solar orbit being common.

The menstrual equation of the Earth, owing to its motion around the centre of motion of the Moon, is about 0 997.

The ratio of the Moon's right and oblique force is 1 00406 to 1.

The evection is the action of the Sun on the Moon's orbit, which lessens the eccentricity in the syzygyes, and increases it in the quarters.

The annual equation is the increase of the Moon's orbit and period when the Earth is in perihelion, and the decrease of orbit and period in aphelion.

A lunar day is 24 hours 50 minutes 28 seconds, and in that time the Tides rise twice.

The Equinoxes and Apsides.

As the Earth, like every other revolving body, turns once on its axis while revolving round the Sun, (as the mechanical effect of the orbit,) and as this extra rotation is not lost, so it displays itself, first, by arriving at an orbit point too soon, and by a subsequent extension of the orbit.

The *Equinoctial* year is 365·2422569 days, log. 2·562581. The *Sidereal* is 365·256384, log. 2·562598. The return to the Apses or *anomolistic* and physical year is 365·259703, log. 2·562602. These, as the last determinations, give 365d. 5h. 48m. 51 sec., 6h. 9m. 9·577 sec. and 6h. 14m. 16·34 sec. That is, 365 days, and 20931 seconds of time over, 22149 seconds over, and 22456 over. Or, as to space 859″·57, 909″·66, and 922″·22 over the tropical year. Taking the sidereal as the true orbit of 360°, the tropical orbit or return, the point for the next year to the Sun is in 359° 59′ 9″·91, and the orbit is increased as to the apsis to 360° 0′ 12″·56.

The Earth makes one silent rotation by going round in an orbit, and this is measured by the difference between the sidereal and solar day. The diurnal rotations are produced by the orbit force, but this incidental rotation is merely a rotation from change of position as to the Sun, while as a rotation it has its own force, and this necessarily carries it onward a whole circumference in the orbit. This quantity, 24,897 miles, is therefore gained in the orbit, and the arrival at the former solar nodes or points are quickened; hence the old node is anticipated by that quantity which, at 93 millions distance, is in the orbit an angle of 55·2237 seconds, and at 94½ as 54·647 seconds. But, as this last in the ecliptic is in the equator as 1·098 to 1, it becomes 50·098 seconds = 20 minutes 19·9 seconds, the exact precession of the equinoxes.

In regard to its orbit, the Earth has two relations, one physical to the central Sun, and another visual to the external stars. In regard to time, its mean motions being equable, every *gain* in time is a *loss* of motion, and every *loss* of time is a *gain* of motion, or as time diminishes, motion increases, and as time increases, motion is decreased. So in regard to motions, every increase in the same distance is a decrease to time, and every decrease in motion is an increase of time. Then, in regard to the Sun and stars, every acceleration in the solar orbit is an acceleration of visible solar points, and an advance of the stars as to those points; and every retardation in the orbit as to the central sun is a retardation of visible solar points, and a falling back as to the stars.

The early approach of the point of the tropic might be taken at the solstices, or any other solar point, for it in no way varies, the real orbit not being itself any motion or measure. If in a road-book an inn were put down five miles farther off than it proved to be, the meeting it five miles sooner would not extend or shorten the length of the whole road.

The sidereal year is, therefore, the true solar year, and the anomalistic the true physical year. The one is 360°, and the other 360° 0′ 12″·56.

The tropical stop = 359° 59′ 9″·91.

The sidereal circle = 360°.

The physical year = 360° 0′ 12″·56.

The whole excess over the tropical 62″·65 (usually taken as 61 99) is quite neutral, but the tropic being made the standard, measured from in all years, so 62″·65 is a constant excess over the shortened tropical.

Then, with reference to the extra circumference of the Earth, 24,899 miles, with 8·7 parallax, it is 54″ 69 in the orbit; with 8·75 parallax it is 55″; and with 8 8 parallax it is 55 318; while 50° 098 in the *Ecliptic* is 54·613, being as exact a coincidence with the parallax 8 7 as could be expected. Therefore, the extra circumference, incidentally in operation, is the cause of that acceleration which carries the Earth to the Tropic or Equator before its sidereal period.

The *Sidereal* or complete revolution of the Earth round the Sun, is performed in 365 days 6 hours 9 minutes 9·6 seconds, or 9″·577; or 365·256384 days. Log. 2·562598.

It commences from the last Tropic, and is measured to the return to a point which is 360° from that last tropic. But before completing the 360° or sidereal year, (the Earth being accelerated by an extra rotation from going round in an orbit) it arrives at the Tropic 50″·098 of space, or 1219·9 seconds too soon. The point in the Equator which the Earth's centre crosses in the Ecliptic being determined by the Stars, these as to the Tropic seem to advance; and to complete the 360° the Earth has to move other 50″·098 of space, or 1219·9 seconds of time.

If we imagine two hoops crossing as Nodes at an angle of 23° ·27′ ·40″, and one of them representing the orbit, it is evident that an increase of orbit motion, at the *same* mean distance from the prime mover, must occasion the Earth to arrive at the Nodes or Tropics sooner by a space equal to the increased motion.

The *tropical* year, which determines

our seasons, is 365·5·48 49″·7, or 51″, or 365·2422569 days, log. 2·562581, seeming to fall back, as to the Stars, it occasions their apparent advance of a degree in 71·86 years, or through 360° in 25,869 years.

The *sidereal* year of 360° does not, however, complete the revolution of the major axis of the Earth's orbit, for this advances other 307 or 306·763 seconds of time, or 12″ 56 of space; and then this advance perfects the *orbital* or *anomalistic* year of 365·259703 days, log. 2·5626O2. It consists of 365 days and 22456 seconds.

These additions are, however, parts of the true orbit, and are not to be mixed in any way with relations of the measure to the tropic, and the apparent retreat of the kind of the mile-stone, called the tropic.

The quantity of the precession, and the apsides' overplus being performed beyond the Equinoctial, (as measured at those points,) it appears that the Equinoctial, from whence R. A. is reckoned, must constantly vary, and hence those northings and southings of which Pond complained, but which have never before been explained. Hence, if the whole quantity 10″·87 is taken, the Equinoctial would move N. and S. round the heavens in 1,192,000 years.

Extending this principle to Venus, we find the retreat of her node 31″·4 as the first quantity, and the ecliptic advance of her apsides 47″·4, making 78″·8. Thus we get 72″·3 as the measure of her circumference in her orbit. Then log. of 72·3 from log. of 1296000 seconds in orbit, gives log. 4·253467 for the number of circumferences, and the log. of Venus's circumference in miles is 4·383643. Then 4·253347 + 4383643 = 8·637110 Venus's whole orbit in miles. From this take the log. of 6·2832, and we get log. of Venus's distance 7·838930, and the log. of the agreed distance is 7·838849

This example, and those of the Earth and Moon, prove the principle that the retreat of the nodes is truly an advance of the planets on the nodal points, and that the advance of the major axis is solely caused by the addition of a circumference to the orbit, subject, nevertheless, to modifications from satellites, &c. &c.

Precession and Apsides.

Astronomers mistake in deducting the retrocession of the Nodes from the advance of the Apsides. The one is terrestrial only, and the other relates to the change of position of the orbit. The imaginary point of the Node does not move; but only the Earth sooner crosses the Ecliptic, and this has no concern with the orbit and its motions by the advance of the major axis. The difference, if correct, would extend the revolution of the Apsides to 109,830 years.

As the force is alternately North and South of the Equator at each Node, the Nutation of the axis is a consequence, dependant on the lat. of the Moon, and this again on the Moon's Nodes, as is the fact.

The solar parallax is varied by instruments, from 8″·578 to 9″·343, but the true mean parallax is the quantity 55″·1335, which the Earth's circumference measures in the orbit, divided by 6·2832, *i. e.* 8″·775; which, by 12·5664, is equal to the joint angle of the precession, and the advance of the Apsides, with some very small allowance for obliquity, &c.

As the radius and circle have similar ratios, the number of Earth's circumferences in the orbit is also the number of semi-diameters in the distance. The former is at a mean about 23452 = 55″·262 for a circumference; and this, by 6·2832, gives a parallax = 8″·7952, subject to reduction for the Moon. Then, 23452 × 2 and 55·262 × 2 = the joint periods and seconds of the precession and Apsides.

Small discrepancies grow out of data involved in other quantities, and it may be doubted, whether observations are correct within half a second, and also whether the present are mean measures; the mean precession for 200 years, for example, was 50″·3, but the last 4 make it only 50·098. So the Apsides is called 61″·9, but the exact time makes it 61″·583, or ·56.

We determine the position of the New Equinoxial, or its distance from the old one at the completion of the sid. orbit, thus.

As Rad. to 50″·09	1 699751
So Tang. 23·2737	9 637495
To New Dec. 21″·74, or 10″ 87 for N. and S.	1 337246

The product of the sine of the Polar inclination by its cosine, or the sine of the complement by the trigonometrical radius 10, is equal to the number of days and parts of a day in the revolution of the Earth round the Sun. Thus P. sine × P. cosine × 10 as Radius = Days, &c. in a year.

Sine 23° 27′ 43″ 58	...... =	0·600012
Cosine Ditto	......	0 962523
Radius 10	....	1 000000
365 d. 5 h. 28′ 53·76″	.. =	2·562565
+ 20 5·7		sidereal over tropical
365 5 48 59 46		

Von Zach makes it 365 days 5 hours 48′ 46″·016, and Quetelet 5 hours 48′ 51″.

Cor. 1. As all history fixes the gross number of days, then if the angle of obliquity varies we may infer that the distance varies, so as to vary the Solar force acting as 10, the relative standard.

Cor. 2. The coincidence shews the identical connection of time and motion, for, in fact, the resulting expression may be called rotations and parts of a rotation, instead of days, hours, &c.

Cor. 3. As the inclination varies a degree in 7500 years, so in that time the year would be 11 days longer, or the Earth would be nearly a million of miles nearer the Sun, which last is the more probable result.

The tropical year is 4′ 21″ shorter than in the time of Hipparchus.

CHEMISTRY.

CHEMISTRY is the science of atoms; it detects their relative powers, their laws of combination, and their means of decomposition. It enables us, in conventional language, to understand the construction of bodies, and is one of the most instructive and most useful studies.

Beyond all question, the activity of atoms, their actions and reactions, and their astonishing excitements, are derived from the great motions of the Earth of 65,000 miles direct, and 1000 deflected and oblique in every hour. We see the effect of the action and reaction of the Moon in the waters, and we may infer, that the great motions have greater power on the divisible solid parts. The action, too, is *constant*, and has continued for *indefinite ages*, so that order and system would now characterize every motion and result; and establish a succession of dependence and of activity with perfect harmony. To this primary cause we are also to ascribe correlative actions in the effects which we call electricity, the laws of the diffusion of heat, evaporation, &c., also the definite proportion of kinds of atoms mingled in substances, governed as the whole are by the arithmetic of motion. To the same cause we are also to refer those relative effects on one kind of matter or another, called their antagonist qualities, and all their decomposing and recomposing powers.

The science of Chemistry assumed its modern character in the hands of Beccher and Stahl, residents of Mentz. They first perceived the connection of the atmosphere and of gases, with the production of phenomena, and paved the way for the discoveries of Bergman and Scheele, two Swedes, who died in 1784 and 1786, and those of Priestley in England, and Lavoisier in France; while Berzelius, another Swede, Fourcroy, Berthollet, and Gay Lussac, in France; Higgins, Dalton, Thompson, Wollaston, Davy, and Faraday, in England, have conferred precision on its pursuits.

Cavendish, in 1766, discovered hydrogen. Priestley, between 1774 and 1779, discovered oxygen, azote, and nitrous gas. In 1784, Cavendish decomposed water. In 1775, Lavoisier analyzed atmospheric air, combustion, &c. In 1784, the New Nomenclature appeared, and conferred conventional language.

The first object is the Nomenclature:

Sulphur, by combining with oxygen, produces an *acid*. But this acid is in two states of saturation, having different properties. It is then requisite to follow all the *saline* compounds of these two acids, and to attend to sulphur in its other direct combinations, with *earths*, *alkalies*, and *metals*. *Five* terminations distinguish these *five* states of the same principle.

1. *Sulphur* ic acid denotes sulphur in the utmost degree of saturation with oxygen.
2. *Sulphur* ous acid denotes sulphur united with a smaller proportion of oxygen.
3. *Sulph* ate is the generic name of all the *salts* formed by the sulphur*ic* acid.
4. *Sulph* ite is the name of the salts formed by the sulphur*ous* acid.
5. *Sulphur* et is the name of all the combinations of sulphur not acidulous.

Combined with oxygen, Carbon is *Carbonic acid*.

The same in gas, is *carbonic acid gas*.

Oxydized, and forming salts with bases of earth, alkali, or metal, it is called *carbonate* of lime, or potash, or iron.

Combined without oxygen, it becomes with iron *carbur* et of iron, &c.

Salts are distinguished by two names, one denoting *the acid*, the other *the base*. Thus, sulph *ate* of soda is a combination of sulphur *ic* acid and soda; sulph *ate* of iron is compounded of sulphur *ic* acid and iron; muri *ate* of soda is a compound of muriat *ic* acid and soda. Salts composed of acids ending in *ous*, have the termination *ite* instead of *ate*.

Example in Sulphur:
Sulphur *ic* acid, a strong acid.
Sulphur *ous* acid, a weak one.
Sulphur *et* of iron, sulphur and iron.
Prot-oxide of sulphur is the first degree.
Deut-oxide the second degree.
Trit-oxide the third degree.
Per-oxide many degrees.
Sulph *ate* is the salt of sulphur *ic* acid.
Sulph *ite* the salt of sulphur *ous* acid.
Bi-sulphate the salt of a double dose.
Hypo-sulphurous acid,—less oxygen than sulphurous acid (1 to 2).
Hypo-sulphuric acid,—less than sulphuric.

A *Laboratory* consists of a furnace, sand-baths, tables, filtering-stands, sink, cupboards, shelves, crucibles, flasks, retorts, receivers, bottles, a mortar, an anvil, and carpenters' tools; blow-pipe, spatulas, glass-tubes, lute-sand, charcoal, weights, scales, and measures; an Argand lamp, thermometers, pyrometer, barometer, hygrometer, hydrometer, Wollaston's scale, &c. &c.

All compound bodies, even the smallest portions of them, are composed of the same constituents, united in *fixed proportions*. This discovery was made by Higgins, Bergman, Kirwan, and Weusel; and perfected by Richter, Berthollet, Wollaston, and Dalton. Gay Lussac also shewed that one volume of any gas always combines with one, two, or three of another gas.

Weusel, in 1777; Higgins, in 1789; and Richter, in 1792, announced the fact with full details, that atoms of different bodies unite only in definite proportions, or in even multiples of those proportions. In 1804, Dalton *adopted* the views of Weusel, Higgins, and Richter, and Thomson, Berzelius, and Wollaston, gave them currency. It is, in fact, now believed, that all the elements are exact multiples of the weight of atoms of hydrogen.

Compounded bodies, whose elements are gaseous, consist either of equal volumes of those elements, or, if one exceed the other, the excess is some multiple of the volume.

This subservience to arithmetic, proves that the whole is mechanical, and at no

time is there any resultant of powers, *per se*, or *sui generis*.

It was for ages well known to every apothecary's apprentice, that solutions took and take place only in known definite ratios, and it had been published in many books that 2¼ lbs. of water would dissolve 1 lb. of common salt, or 1 lb. of water $6\frac{4}{10}$ oz. of salt. A lb. of water was then put into a long necked bottle, and marked with a file where it was $\frac{13}{16}$ inch wide, tapering upward to $\frac{11}{16}$. Then 220 grains of salt raised the water half an inch; then 72 grains of sugar raised the half inch to ¾; and afterwards 24 grains of alum raised it to a full inch; and an additional 24 grains raised the water to 1¼ inch.—*Higgins*.

In rendering these relations numerical, some body is taken as a standard, that which combines in the smallest proportions, and this being hydrogen, it is made the integer, or 1. The next is carbon, 6; the next is oxygen, 8; and the next nitrogen, 14.

Whether two substances combine by weights or volumes, the proportions are the same; the numbers, therefore, for the gases are the same as their base.

Wollaston's scale greatly simplifies this Atomic Theory. It gives the best determinations of numbers, and multiplies the constituents at sight.

Some chemists consider the numbers as the weight of single atoms of the bodies, the ratios holding for any number.

The weight of an atom of hydrogen is 0·132, but it is taken, on Wollaston's scale, as one-eighth of an atom of oxygen at 1, or as 0·125; or oxygen being taken as 8, hydrogen of course is 1.

Brande makes oxygen 7·5, water 8·5, chlorine 33·5, nitrogen 13, sulphur 15, phosphorous 11, and carbon 5·7. Then, as 8 parts by weight of oxygen, and one of hydrogen, form *water*, the equivalent numbers of the three are 8, 1, 9.

If oxygen be taken as 10, then hydrogen is 1·25, and water 11·25.

If oxygen be taken as 1, then hydrogen is 0·125, and water 1·125.

Berzelius makes oxygen 100, hydrogen 12·5, &c. But 8 for oxygen is generally used.

An atom of carbon is 0·751; of sulphur 2·0434; of ammonia is 2·128; of magnesia 2·503; of lime 3·62; of barytes 9·7; of oxalic acid 4·625; of chlorine is 4·498. An atom of platinum is 12·161; of gold 24·838; of silver 13·714; of iron 7·143; of copper 8; of antimony 11·219; of lead 25·974; of tin 14·705; of manganese 6·833.

These are the *standards* for the equivalents of all other bodies.

Bodies of two equivalents, or atoms, are *binary*, as water, 1 O + 1 H, and carbonic oxide, 1 O + 1 C. Others of three, *ternary*, as deutoxide of hydrogen, 2 O + 1 H, and carbonic acid, 2 O + 1 C; others *quarternary*, &c.

Water is formed in bulk of *one volume* of oxygen, and *two volumes* of hydrogen; for, when water is decomposed by electricity, the hydrogen at the negative pole is double the volume of the oxygen at the positive.

A cubic foot of water is 1000 ounces of 437·5 grains each, *i. e.* 437,500 grains. Then a cubic foot of hydrogen weighs but 38 grains, so that water is to hydr. as 11,500 to 1.

GASES or their Bases, and the Principal ACIDS, are as under:—

Peroxide of Hydrogen	H.	1	+	O 16	=	17
Nitrous Oxide	N.	14	+	O 8	=	22
Nitric Oxide	N.	14	+	O 16	=	30
Hyponitrous Acid	N.	14	+	O 24	=	38
Nitrous Acid	N.	14	+	O 32	=	46
Nitric Acid	N.	14	+	O 40	=	54
Carbonic Acid	C.	6	+	O 16	=	22
Carbonic Oxide	C.	6	+	O 8	=	14
Hyposulphurous Acid	S.	32	+	O 8	=	40
Sulphurous Acid	S.	16	+	O 16	=	32
Sulphuric Acid	S.	16	+	O 24	=	40
Hyposulphuric Acid	S.	32	+	O 40	=	72
Phosphoric Acid	Ph.	31·42	+	O 40	=	71·42
Muriatic Acid Gas	Ch.	36	+	H 1	=	37
Protoxide of Chlorine	Ch.	36	+	O 8	=	44
Peroxide ditto	Ch.	36	+	O 32	=	68
Chloric Acid	Ch.	36	+	O 40	=	76
Perchloric Acid	Ch.	36	+	O 56	=	92
Perchloride of Carbon	Ch.	108	+	C 12	=	120
Hydriodic Acid	Iod.	126	+	H 1	=	127
Ammoniacal Gas	H.	3	+	N 14	=	17
Carburetted Hydrogen	H.	2	+	C 6	=	8
Olefiant Gas	H.	2	+	C 12	=	14
Sulphuretted Hydrogen	S.	16	+	H 1	=	17
Phosphuretted Hydrogen	Ph.	94·26	+	H 1	=	95·26
Prussic Acid	Cy.	26	+	H 1	=	27
Cyanogen	C.	12	+	N 14	=	26

For SPECIFIC GRAVITIES, *See* former article.

Taking hydrogen as 1. and oxygen as 8, the whole are as follows: and, from them, the numbers for acids and salts may be easily formed by additions.

Alumina	10	Al.
Antimony	64	Sb.
Arsenic	38	As.
Barium	68	Ba.
Bismuth	72	Bi.
Boron	8	B.
Bromine	80	Br.
Cadmium	56	Cd.
Calcium	20	Ca.
Carbon	6	C.
Cerium	44	Ce.
Chlorine	36	Cl.
Chromium	32	Cr.
Cobalt	26	Co.
Columbium (182) or	144	Cm
Copper (32) or	64	Cu.
Fluorine	10	F.
Gold	100	Au
Hydrogen	1	H.
Iodine (125) or	126	I.
Iridium (100) or	98	Ir.
Iron	28	Fe.
Lead	104	Pb.
Lithium	6	L.
Manganese	28	Mn.
Mercury	100	Hg.
Molybdenum	48	Mo.
Nickel	26	Nk.
Nitrogen	14	N. or Az.
Osmium	100	Os.
Oxygen	8	O.
Palladium	54	Pd.
Phosphorus	16	Ph.
Platinum	96	Pt.
Potassium	40	R.
Rhodium	54	R.
Selenium	40	Se.
Silica	16	Sl.
Silicium	8	Si.
Silver	110	Ag.
Soda	32	Sd.
Sodium	24	N.
Strontium	44	Sr.
Sulphur	16	S.
Tellurium	32	Te.
Tin	58	Sn.
Titanium	26	Ti.
Tungsten	100	Tg.
Uranium	208	U.
Water	9	Aq.
Yttrium	36	Y.
Zinc	26	Zn.
Zirconium	22	Z.

100 parts of pure *Water* contain 88·9 of oxygen to 11·1 of hydrogen, or 8 to 1.

A cubic inch of *Water*, ther. 60 deg. weighs 252·52 grains, and contains 28·06 grains of hydrogen and 224·46 oxygen.

The maximum density of *Water* is at 39° 39′, and it expands as cooled to 32°, the freezing point. In freezing, it further expands, so that a cubic inch of water has displayed a force of 27,000 lbs.

If *Water* is saturated with a third of its weight of salt, it will still dissolve sugar; saturated with carbonic acid it dissolves iron.

Aqueous vapour at 32° raises the mercury 0·2; at 80°, an inch; at 163°, 10 inches; at 180°, 15; and at 212°, about 30.

At 60° the aqueous vapour is 1·6th; at 93°, 1·20th. In Madeira, the quantities vary from 1.35th to 1.100th.

The difference between Thames and distilled *Water* is as 1·0006 to 1. Rain-water is equivalent to distilled water.

Water may be saturated with oxygen by the peroxide of barium. When at the specific gravity of 1·45 it acts as a caustic on the skin, and detonates on being thrown on finely-divided silver, and on some of the other metals in powder.—*Thenard.*

Oxygenated water is a compound of 1 hydrogen, and 16 oxygen.

Oxygenated water, or peroxide of hydrogen, is easily restored into oxygen and water by mixing alkalies, or by introducing solid metals, which act just as alkalies, and without being changed. The effect is electrical between the uncombined oxygen and the alkaline base of the metal; and is a new form of galvanic action, proving that all metals are like potassium, &c.; that is, alkalies and earth, while crude ores, as generated by galvanic action in veins, are oxygen, hydrogen, and aura of rocky matter.

Water heated in a strong closed vessel has melted lead at 612°.

Perkins compressed water 1.12th with 2000 atmospheres.

The air which rises from pure water, under an air-pump, contains 34·8 per cent. of oxygen, and, by boiling, 32 per cent. Fish breathe this air.

One carburetted hydrogen explodes with five oxygen.

Atmospheric air is to water as 1 to 828.

Gas, standing over water at 42° Fah. imbibes 0·01 aqueous vapour, at 53° it is 0·015, at 60° it is 0·0186, at 70° it is 0·0256, and 80° it is 0·0353.

100 measures of oxygen gas, at 1·111, and 200 of hydrogen, at 0·0694, form water.

Water boils in the vacuum of a good pump at 70° of heat; with the barometer at 29 at 210°·19; at 30, 212°, and at 31, 213°·76. At 212°, its steam has 1000° of heat.

A pound of water at 60°, and a pound of mercury at 212° give as the mean 64°·9, or 71°·1 too little, and add but 4·9 to the water. The specific heat of mercury to that of water is, therefore, considered 1 to 30. Similar variations appear in other bodies.

The volume of 28·06 hydrogen in gas is 1325 cubic inches; and of 224·46 grains of oxygen is 662 cubic inches; consequently, the cubic inch is expanded 1·987 times.

Air, in 100 volumes, consists of 79·9735 of nitrogen, and 20·0265 of oxygen; 100 cubic inches at a mean is 30·8115 grains.

When 100 volumes of air are mixed with 42 of hydrogen, and exploded, the volumes are reduced to 60. The 42 hydrogen and 21 oxygen are converted into water.

A volume of air contains 0·000415 of carbonic acid gas, or 0·000574 in frost, and 0·000313 in wet weather. This makes the nitrogen 80 and oxygen 20.

100 cubic inches of air are equal to 30·5 grains, of oxygen 33·8, hydrogen 2·1, nitrogen 29·7, chlorine 76·3.

Coal gas, or *Carburetted hydrogen*, is formed by 1 weight of carbon, and 2 weights of hydrogen. Then the number for carbon is 5·7, and for hydrogen 1. Carbon 5·7 + hydrogen 2 = 7·7.

Olefiant gas is constituted of 1 proportional of carbon = 5·7 + hydrogen = 1, and its number is 6·7.

Carbonic acid consists of 2 oxygen, and 1 carbon; and 2 oxygen being 16, and 1 carbon 6, the number for carbonic acid is 16 + 6 = 22.

Ammonia consists of 1 nitrogen, and 3 hydrogen: *i. e.* 14 + 3 = 17.

Four volumes of nitrogen, with one of oxygen, form atmospheric air in all situations, high and low, hot and cold.

A bulk of 1000 of air, at 32 degrees, becomes 1152 at 100 degrees, 1376 at 212 degrees, and 2797 at 1000 degrees. It consists of 79 azote or nitrogen, and 21 of oxygen or vital air *in bulk*. And their specific gravities being 1·093 and ·978, so 100 parts *in weight* is 77·44 nitrogen and 22·57 oxygen.

100 measures of carbonic oxide, and 50 of oxygen, make 100 of carbonic acid.

Metallic *oxides* are formed by one, two, or three equal doses of oxygen.

The oxygen in the acid of *a neutral salt* is a multiple of the oxygen in the base by 2, 3, 4, &c.

100 cubic inches of oxygen, combined with burning charcoal, is 100 of carbonic acid gas, weighing 46·313 grains, of which the carbon weighs 12·641, and the original oxygen 33·672.

100 cubic inches of carburetted hydrogen weigh 29·6 grains, the carbon is 25·4.

100 cubic inches of hydrogen weigh 2·117 grains; and the same, combined with 33·773 sulphur, make 100 of sulphuretted hydrogen gas, weighing 35·89.

100 measures of azote and 300 of hydrogen, make 200 of ammoniacal gas.

And so for other gases, in the exact proportion of their equivalents.

33·5 or 67 of chlorine form *chlorides*.
50·5 or 101 nitric acid form *nitrates*.
37·5 or 75 sulphuric form *sulphates*.
20·7 of carbonic form *carbonates*.
25 of phosphoric form *phosphates*.
15 or 30 sulphur form *sulphurets*.

Copper filings and sulphur unite in the proportions of 80 copper to 20 sulphur, and also 64 of copper to 32 sulphur.

On mixing oxygen and nitrogen, no condensation takes places. The bulk is equal to the bulk of the two, and the specific gravity is the mean of both.

But when 100 measures of carbonic oxide and 50 measures of oxygen gas are united, the compound is only 103 measures; and when 100 measures of azote are mixed with 300 measures of hydrogen, they form only 200 measures of ammoniacal gas.

In mixed gases, the particles of the same only act on each other.

A division of all substances into *electro-negative* and *electro-positive* arises from the position they take when acted on by the poles of a voltaic battery. Those which go to the *negative* pole are called *electro-positive*, and those to the *positive* pole *electro-negative*. Oxygen and chlorine are electro-negative, and hydrogen and nitrogen are electro-positive.

Davy considered the non-metallic elements, oxygen, chlorine, bromine, and iodine, as *electro-negative*; and hydrogen, nitrogen, sulphur, phosphorous, selenium, carbon, silicon, and boron, as *electro-positive*.

Their acid binary compounds are *electro-negative*, and the rest *neutral*, except ammonia, which alone is an alkaline base, or *electro-positive*. Then their unions with *salifiable bases* of the 22 acids are *salts*.

The natural metals afford nine acids, all from 2 arsenic, 2 molybdenum, 2 antimony, 1 columbian, 1 tungsten, and 1 chromium. 22 alkaline binary compounds, and 26 neutral. Their compounds, being reduced at the negative or alkaline side of the voltaic battery, are *electro-negative*.

The oxides of mercury, silver, gold, platinum, rhodium, iridium, osmium, nickel, paladium, and their binary compounds, are reduced by heat alone, and are called electro-positive.

Lead, cobalt, copper, bismuth, arsenic, antimony, and eight others, retain and absorb oxygen at high temperatures.

Tin, iron, zinc, cadmium, manganese, and their binary compounds, retain oxygen, and decompose water, at high temperatures.

Potassium, sodium, and other alkaline metals, decompose water at the common temperature, and absord oxygen at all temperatures.

Silex is acidulous and electro-negative in its affinities. It renders bodies acidulous or electro-negative in various degrees, down to potash, the highest electric positive of alkaline substances.

These terms, electro-positive and electro-negative, are equivalent to the acid and alkaline of the last generation.

Dry alkalies, touched by metals, are positive, and dry acids negative; and dry acids and alkalies similarly affect each other. Davy, therefore, ascribes *chemical affinity* to opposite electrical states.

Oxygen, the supporter of vitality and fire, was first discriminated as a distinct gas by Priestley, in 1774. Its existence was known to Scheele as empyrial air; but, as the antagonist of combustible gas, or Stahl's phlogiston, he called it dephlogisticated air.

Oxygen gas is procured by heating to redness the per-oxide of manganese, which is 28 M + 16 O. One ounce yields 128 cubic inches, and the per-oxide becomes a prot-oxide, or 28 M + 8 O. It is also obtained from chlorate of potash, 124 grains of which yield 48 grains, or 141 cub. in. of oxygen. Also from nitre.

Hydrogen, the phlogiston of Scheele and Priestley, is that gas which, when excited, immediately combines with oxygen, and produces flame, by which the oxygen dis

appears, and a new *concentrated* substance is produced. From this connexion with flame, Cavendish called it inflammable air, but it is now called *hydrogen*, because in bulk it is the chief constituent of water. It is in all bodies which burn with flame.

Hydrogen gas is made by putting iron or zinc into sulphuric acid, diluted with four parts of water. The smell arises from carburetted hydrogen.

An oxide possesses no acid properties, and oxygen gas has neither acid nor alkaline properties; and hydrogen has neither colour, nor taste, nor odour. Neither oxygen, nor hydrogen, change vegetable colours.

Hydrogen is exploded by a burning body, when two parts are mixed with 10 or 12 of air, or with one of oxygen.

Phosphuretted hydrogen is generated by the decomposition of animal bodies, and, hence, has produced phenomena in churchyards favourable to superstition.

Hydrogen and oxygen do not combine at ordinary temperatures, but hydrogen burns, and combines with oxygen, when excited into more motion, or set on fire. A jet of it on spongy platinum takes fire. One lb. in burning, melts 320 lbs. of ice.

Sulphuretted hydrogen is poisonous, and the 250th part of it in the atmosphere has killed a horse. It tarnishes metals; and it gives the flavour of rotten eggs to water.

Sulphuretted hydrogen, 70·857 sulphur and 29·143 hydrogen, changes litmus and radish infusions to red, is soluble in water, and decomposes soap. It is in all respects like an acid, but it changes the syrup of violets green.

Hydrogen gas may be taken into the lungs, but cannot be respired for more than a minute. Small animals die in it much sooner. Sounds in it become acute.

Hydrogen gas may be obtained in marshes or stagnant waters, in hot weather. If a bottle be filled with water, and a funnel put in, and both held downward in a ditch, and the mud stirred at the bottom, the gas rises into the bottle, and displaces the water; lighted, it burns with a fine blue flame.

An ounce of zinc, with water and acid, yields 676 cubic inches of hydrogen gas, and of iron 782.

Priestley discovered *Nitrogen* to be the other component of the atmosphere; and it is also called *Azote*. It is the gas that remains after atmospheric air has been deprived of its oxygen: and it is found to be about four-fifths, 79 to 21, or 4 to 1. Separation may be effected, by putting sulphur and iron filings into a close vessel; they absorb oxygen, and leave hydrogen.

Nitrogen may also be obtained by burning phosphorus under a close vessel, the oxygen being fixed by the combustion, and the residue nitrogen. It is colourless, and devoid of taste or smell, and has no effect on vegetable colours. Berzelius and Davy consider it a compound.

When nitric-acid and oil of turpentine are mingled, and produce flame, it arises from the fixation of the oxygen in one by the hydrogen of the other, as in all cases of ordinary ignition. The previous motion in the fluids is dispersed.

In a mixture of lime, magnesia, and nitric-acid in equal weights, the first and last unite; and if the two last have been united, and lime is presented, the magnesia is separated, and the nitric-acid unites with the lime.

The flame which takes place on mixing phosphuretted hydrogen and oxygen gases, arises from the fixation of the oxygen by the hydrogen, and the radiation of its motion.

Charcoal is a hard substance, unchangeable by heat, or acids, or alkalies, and a non-electric. It absorbs from an eighth to a fifth of its weight of gases, and gives them out again when heated; and it abstracts the odour and colour from most substances.

When duly heated, it is converted into carbonic acid gas; and its pure kinds are *Carbon*, the purest being the diamond, which burnt, becomes carbonic acid.

100 cubic inches of *carbonic acid gas*, or oxide of carbon, weight 46·597 gr., consisting of 33·888 oxygen, and 12·709 of carbon, equal to 22 grains, and have 1·277 specific gravity.

Carbonic Acid gas is a product of fermentation, and, being heavier than air, it lies over all fermentive processes, puts out a candle, and produces suffocation. At the bottom of wells and coal-mines, it causes the choke-damp, in which a light will not burn, but which may be dispersed by throwing water into it.

Water constantly absorbs it in the ratio of pressure, and parts with it when the pressure is removed, called effervescence in bottled liquors. It renders lime-water turbid, and combines with alkalies.

Vast volumes of carbonic acid gas escape from pits and lakes. It abounds in marble and chalk; and may be separated by heat, or by any of the acids. In burning lime, the carbonic acid flies off in gas, leaving the calcareous earth pure.

If we put pounded marble, or lime-stone, into a retort with sulphuric acid diluted with water, carbonic acid will be disengaged, and pure lime will combine with the acid, and form sulphate of lime, or gypsum. If we pour it into a wider-mouthed vessel, though invisible, it will pour out like water.

100 oz. of lime fix 78·5 of carbonic-acid, and this is chalk and marble. 100 of potash fixes 46 of carbonic-acid, and by pressure 92.

Carbonic acid gas reddens litmus paper, and combines with alkalies, alkaline earths, and metallic oxides.

The charred, or carbonized beams at Herculaneum, have undergone no change in 1800 years.

A compound of carbon and hydrogen, called *carburetted hydrogen*, is disengaged in certain natural operations, particularly in the decomposition of vegetables; and it is the gas evolved in stagnant waters. It may be procured by distilling coal. It is also the gas which is evolved at the wick of a lamp or candle, when excited; and by fixing and

continuing to fix the oxygen of the atmosphere, it creates great local heat, which protrudes the surrounding atoms as light.

It is carburetted hydrogen which takes fire in coal-mines, and which, under the name of fire-damp, destroys so many miners.

Silica is the basis of the mineral world, and *Carbon* of the organized.

Pure silex or *silicon* is a dark brown solid without lustre, and infusible.

Sulphur is found in conjunction with silver, copper, antimony, lead, and iron. It is a negative electric, specific gravity 1·99. It melts at 240°, and may be cast to 280°. It thickens by evaporation at 320°, and at 428° becomes a soft paste. At 550° it boils, evaporates, and produces flowers of sulphur.

It has four combinations with oxygen; two and one in hypo-sulphurous acid; one and two in sulphurous acid; one and three in sulphuric acid; and two and five in hypo-sulphuric.

Sulphur is made from pyrites, and has 7 per cent. of orpiment earth; but volcanic sulphur brought from Italy has but three per cent. 15,000 tons per annum are imported, to make gunpowder and sulph. acid.

Phosphorus is the base of an acid found in urine and bones, and the oxygen is detached by charcoal at a red heat. Re-burnt, it forms flakes, and these absorbing vapour become liquid phosphorous acid. It also abstracts oxygen from nitric acid, and is very powerful, being two phosphorus, and five oxygen = 71·42.

Phosphoric acid is a very abundant substance, and composes mountains with lime in Spain, &c. It also abounds in ores and animal substances.

Various preparations of *Phosphorus* are used to produce quick inflammation. One of the best is made by putting a piece of phosphorus, an inch long, into a small strong phial, and holding it near the candle, until it melts all over the inside of the glass. If it should inflame by the heat, it is to be immediately stopped. When a light is wanted, a common sulphur-match is to be dipped in the phial, and briskly rubbed against the inside. On withdrawing the match, it will generally be found to be inflamed; or, if not, this will be sure to take place by rubbing its point over the top of the cork.

Chlorine, or green gas, properly *oxy-muriatic acid*, is considered as a simple substance, specific gravity 2·5; though it yields oxygen by supporting combustion, and combines with hydrogen greedily. It is produced from the action of muriatic acid (36 Ch. + 4 Hyd.) on peroxide of manganese (28 M + 16 O). The results are water, 8 O + 1 H, and 36 Ch.; with 28 M + 8 O. —*Davy.*

Oxymuriatic acid is called *chlorine*, and assured to be an element; and muriatic acid is asserted to be chlorine and hydrogen, and, therefore, called *hydro-chloric acid.* But, the inference is questionable, in spite of forced analogies drawn from iodine, fluor, and bromic hydracids.

Chlorine, or oxymuriatic acid, is the basis of salt, which consists of Ch. 36 + Sodium 24: for, when sulphuric acid is added, its water is decomposed, the hydrogen unites with the Ch. 36, and forms muriatic acid gas 37; and the sodium becomes sulphate of soda.—*Davy.*

The specific gravity of *muriatic acid* gas is 1·2847; and it consists of equal volumes of chlorine and hydrogen. It absorbs water so instantly as at once to melt ice. Water absorbs 480 times of its bulk of the gas, becoming 1·2109.

Chlorine gas destroys the volatile effluvia of putrefaction and infection; and a solution of the chloride of lime is bleaching powder, and employed in fabrics. A table-spoonful in a wine-glass of water, spread on a plate, destroys all infection, and purifies the air of sick chambers, infected houses, removes smells from drains, privies, &c.

Chlorine combines with all metals, and with some in such intense force as to produce flame, as in powdered zinc, arsenic, and antimony.

Iodine, or violet gas, resembles chloride gas, and has some of its characters, besides being a product of sea-weeds. Its specific gravity 8·7, and 100 cubic inches weigh 262 grains. It is a simple substance of the specific gravity of nearly 5. Its odour is like chlorine, and it is very active. It is of a violet colour, easily evaporates, and melts at 220°. It changes vegetable blues to yellow, and a seven-thousandth part converts water to a deep yellow colour, and starch into purple.

Five volumes of oxygen and one of iodine form *iodic acid.* It is made from *kelp;* is of a dark grey colour, and metallic lustre, and in its gaseous state is purple. It is a remedy in bronchocele.

Iodine, whose vapour is violet-blue, with mercury is red, and with lead yellow. Brown oxide of copper produces green and blue salts. Yellow oxide of lead has colourless salts.

Starch and iodine are delicate tests of each other. Iodine, in strong ammonia, forms a highly-detonating powder, being iodide of nitrogen.

Bromine is a product of sea-water.

Naphtha, &c. are carburets of hydrogen in equal proportions.

Olefiant gas is six parts of alcohol, and 16 of strong sulphuric acid, gasified by heat. Its specific gravity 0·9722; and it is carbon $2 \times 6 = 12$, hydrogen $2 \times 1 = 2$. *i. e.* 14.

The deutoxide of lead and the peroxide of iron combine in $\frac{8}{2}$ proportions of oxygen, and not evenly, as in other cases.

Carbonic oxide gas is 1 C + 1 O = 14, and is inflammable, but arrests animal life hence the carbon in it, as well as diamond, and all carbon must contain hydrogen; and, in proof, burnt carbonic oxide is carbonic acid with another dose of oxygen.

The vapour of water is equal to the volume of hydrogen contained in it.

THENARD enumerates 28 gases at the

freezing point of water. Chlorine and its compounds are green, and nitrous vapour red. Hydrochloric, fluoboric, fluosilicic, and hydriodic, produce white vapours.

Inflammable gases are hydrogen, and its sulphurets, arsenurets, tellurets, selenurets, and potassurets; also hydrurets of phosphorus and of carbon, carbonic oxide, and cyanogen.

Supporters of flame are oxygen, oxide of azote, and of chlorine. Acid gases, which redden litmus, are sulphurous, fluoboric, fluosilicic, hydriodic, hydro-chloric, carbonic, and chloro-carbonic.

Sulphurets and tellurets of hydrogen, and cyanogen, oxide of chlorine, destroy the red which they first produce.

Oxygen, azote, hydrogen, hydruret of carbon, carbonic acid, and oxide of azote, have little odour compared with others.

Those soluble in one-thirtieth of water are fluoboric, fluosilicic, hydro-chloric, hydriodic, sulphurous acid, and ammonia.

The acid gases, sulphurets, and tellurets of hydrogen, chlorine, cyanogen, and ammonia, are soluble in alkaline mixtures, and alkaline gas in ammonia.

The specific gravity and weight of the principal gases are—

		Weight per cubic inch.
Atmospheric air	1·0000	0·305
Oxygen	1·1111	0·33888
Hydrogen	0·0745	0·02118
Nitrogen	0·9722	0·29652
Sulphurous acid gas	2·222	0·67776
Chlorine gas	2·496	0·7625
Muriatic acid gas	1·2847	0·39184
Carburetted hydrogen	0·5554	0·16939
Carbonic acid	1·5277	0·46597

The five heaviest gases are—

Chloric gas	2·496
Nitric acid gas	2·427
Sulphurous acid gas	2·222
Vapour of ether	2·25
Vapour of alcohol	2·1

The four lightest gases are—

Carburetted hydrogen	0·555
Arseniacal hydrogen	0·529
Phosphuretted hydrogen	0·352
Hydrogen	0·745

A careful comparison of determinations makes the specific gravities of certain gases as follow:—nitrogen $\frac{35}{36}$, oxygen $\frac{10}{9}$, hydrogen $\frac{10}{144}$, chlorine $2\frac{1}{2}$, steam 0·6235, muriatic acid gas, 1·2843, cyanogen 1·8064, carbon vapour $\frac{10}{12}$, olefiant gas 0·9709, sulphuretted hydrogen $\frac{20}{9}$, sulphur vapour $\frac{60}{9}$. The specific gravity of all gaseous bodies is the product of the sum of the atomic weights of their single groupes into $\frac{10}{144}$. The whole are also given in a former table.

Dr. Faraday, by decomposing hydrate of chlorine, produced chlorine itself, in a liquid state, *very volatile*, with a specific gravity of 1·33. Davy, from muriate of ammonia and sulphuric acid, produced muriatic acid gas *as liquid;* its explosive pressure at 50° was equal to 40 atmospheres. Faraday has also produced *liquid* sulphurous acid from the *gas*. It did not freeze at zero, but rapidly evaporated, as the gas, and at 45° expanded as two atmospheres. Its specific gravity is 1·42. He also produced *liquid* of sulphuretted hydrogen gas from muriatic acid and sulphuret of iron; compared with which, ether was tenacious and oily. It instantly dispersed with a force of 17 atmospheres at 50°, and its specific gravity was 0·9. And *liquid* carbonic acid from carbonate of ammonia and concentrated sulphuric acid. It volatizes from the freezing-point to zero, with a force of 36 atmospheres, and is dangerous. Euchlorine was also *liquified;* but the tube burst before it could be examined. Nitrous oxide was also distilled in a tube, by heat at one end and cold at the other, from nitrate of ammonia; but it instantly exploded, with a force of 50 atmospheres. Carbonic acid gas requires the pressure of 60 atmospheres to reduce it to a *liquid*, and the pressure of the liquid is equal to this power, as long as any of the liquid continues. Cyanogen, from cyanuret of mercury, had a specific gravity of 0·9, and evaporated, with great cold, at 45°, with a force of 3·7 atmospheres. Ammonia gave *a liquid*, specific gravity 0·76, with 6·5 atmospheres, at 50°.

A French chemist has solidified sulphuric acid, and made an hydrate useful, at least, in carriage.

Carbonic acid has been solidified and liquified by Thilorier. The specific gravity of the liquid is 0·83. A jet of the liquid carbonic acid, directed on the bulb of a spirit thermometer, made it fall to 194° below zero. A jet passed into a phial is expanded 400 times, and the cold solidifies it, as a white powder. Then, if the finger is placed on the powder, the expansion repels the finger, the cold being 231° below zero!

Liquid carbonic acid expands 20 and 29 times equal to 36 and 73 atmosphres, from 32 to 86. It is soluble in alcohol, ether, &c. Mixed with ether it congealed 772 grains of mercury in a few seconds. A jet of it on the finger almost destroys its vitality.

Attempts to produce hydrogen, oxygen, &c. by generating them under the pressure of strong glass tubes, and condensing with cold, did not succeed.

Oxygen gas is produced by heating to redness the peroxide of manganese in an iron retort.

Oxygen gas in a small closed vessel, consumes charcoal half kindled; phosphorus and watch-spring, or wire, heated at the end with astonishing intensity, proving that they contained hydrogen, and in the process the oxygen, as gas, disappears, and acids are the products. It equally sustains animals, but is an over-stimulant.

480 grains of zinc slips, effervesced with dilute sulphuric acid, gives out 676 cubic inches of *hydrogen*. And 480 grains of iron-filings with the same, gives out 782 cubic inches of hydrogen. That from zinc

is purified by passing it through a solution of caustic potash, and that from iron, by passing it through alcohol.

Aqueous vapour, passed over red-hot iron in a glass tube, is decomposed into oxygen, which oxidates the metal, and pure hydrogen corresponding in weight. So oxygen and hydrogen burned in a glass vessel, produces water equal to their weight.

The measures of exploding oxygen and hydrogen, are 1 of oxygen to 2 of hydrogen. And of air and hydrogen, is 5 or 6 of air to 2 of hydrogen.

A burnt body is one that has lost its hydrogen, while its weight is increased by the oxygen fixed in parting with its heat or motion. Mercury may be oxydized by oxygen, and the compound be equal to the weight of both; and the oxygen may afterwards be expelled, and the weights be restored as at first.

An hydrogen jet thrown on spongy platina, makes it red-hot, and this fires the hydrogen.

ACIDS are of four kinds, viz. *the mineral acids*, as the sulphuric acid; the *metallic acids*, as the arsenious; the *vegetable acids*, as the acetous, or malic; and the *animal acids*, as the phosphoric and lactic acids.

Sixteen are from the *mineral* kingdom: 1. The sulphuric acid. 2. The sulphurous. 3. The nitric. 4. The muriatic. 5. The oxygenated muriatic. 6. The hyper-oxygenated muriatic or chlorine. 7. The carbonic. 8. The phosphoric. 9. The phosphorous. 10. The boracic. 11. The fluoric. 12. The arsenic. 13. The arsenious. 14. The molybdic. 15. The molybdenous. 16. The chromic.

The *vegetable* kingdom furnishes 12. 1. The acetous. 2 The acetic. 3 The oxalic. 4. The malic. 5. The citric. 6. The tartarous. 7. The mucous. 8. The gallic. 9. The benzoic. 10. The succinic. 11. The camphoric. 12 The suberic.

The *animal* kingdom supplies 5. 1. The prussic. 2. The lithic. 3. The sebacic. 4. Margaric 5. Stearic.

Besides these, there are, 1. The mellitic. 2. The moroxylic. 3. The amniotic. 4. The bombic. 5. The laccic. 6. The rosacic. 7. The fulmanic.

Many of the Acids are found in great abundance in nature, but combined with other substances. Thus, the vast masses of limestone, chalk, and marble, found in every part of the world, are combinations of lime and carbonic acid; gypsum, of which there is so much in different parts of the globe, is composed of lime and sulphuric acid.

The most powerful known poison is *Prussic* acid, called hydrocyanic, and formed from cyanogen, or carburet of nitrogen and hydrogen. The acid in vapour at a moderate heat fills the retort and condenses. A single drop put on the tongue of a large dog kills it instantly. It appears to destroy the nervous system. It reddens vegetables, and its constituents are two volumes of carbon, one of hydrogen, and one of nitrogen; it may also be extracted from bitter almonds. *Prussic* acid is also obtained from green-tea, and souchong is as effectual in poisoning flies as arsenic.

The antidotes mentioned should be immediately given in solution; and the stomach-pump, or an emetic of white vitriol, blue vitriol, or ipecacuanha, employed to evacuate the stomach, and bring away the poison.

POISONS.—*Acid Sulphuric*, or oil of vitriol.

Acid Hydrochloric, or muriatic.

Acid Nitric, or aqua-fortis.

Acid Oxalic, (salt of lemons,) often mistaken for Epsom Salts.

Antidotes.—Chalk magnesia, or the plaster of the apartment made into a paste, with water. Solution of soap. Diluents before and after the administrations of the antidotes.

Acid Hydrocyanic, or prussic; laurel water and cyanuret of potassium. *Antidotes.*—Cold affusion; inhalation of diluted ammonia, or chlorine.

Antimony, Tartar Emetic. — *Antidote.* Administer large doses of warm water to induce vomiting; give the powder of Peruvian bark; and, as soon as it can be prepared, the infusion of bark, which decomposes the tartar emetic.

Arsenic (the white oxide).—*Antidote.* The hydrated tritoxide of iron in a dose thirty times greater than that of the poison.

Baryta (the oxide, the muriate, and the carbonate). *Antidotes.*—Sulphate of magnesia, (Epsom salts), sulphate of soda, (Glauber's salts), or any alkaline or earthy sulphate.

Cantharides.—*Antidotes* Emetics, if required, demulcents, leeches, and bleeding. Where strangury was produced by a blister, gold beater's-leaf laid on the plaster obviates this inconvenience, without preventing the usual action of the cantharides.

Poisonous Fungi (mushrooms). Emetics.

Sulphuretted Hydrogen.—*Carbonic Acid* (in brewers' vats, &c. Fumes of burning charcoal).

Antidotes. Free exposure in the air, moderate blood-letting from the arm, or from the head.

Copper. Blue vitriol and verdigris. (Sulphate and acetates of copper).—*Antidotes.* White of eggs, iron-filings, and ferrocyanate of potassium in solution.

Lead. Litharge, red lead, white lead, sugar of lead, and Goulard's extract.—In the first stage, or the irritant form of injury, administer sulphate of magnesia, potash, or soda. The phosphate of soda is a good antidote. When palsy supervenes, the regimen must be regulated carefully.

Mercury, the bichloride. (Corrosive sublimate.) *Antidotes.*—White of egg diluted in water; or milk, if eggs cannot be obtained.

Strychnia. Nux Vomica. Evacuate the stomach with the stomach pump, or emetics No antidote is known.

Opium; Laudanum. Antidotes.—Emetics of the sulphate of zinc, (half a dram, or two scruples,) the stomach pump: or injections of tartar emetic must be employed to

bring away the poison. The patient should be constantly roused by dragging about the floor, throwing cold water in the face, and giving ammonia, assafœtida, &c. Bleeding sometimes.

Zinc Sulphate (white vitriol). *Antidotes.*—Potass in syrup; also cream, butter, and chalk.

Acids change blue, purple, and green colours of vegetables into red; and neutralize alkalies and earth. Their elementary principle is oxygen.

Aqua-fortis, or *nitric acid*, is, by volume, 100 nitrogen to 250 oxygen; and, by weight, equivalent 14 of nitrogen to 5 of oxygen, $5 \times 8 = 40$. So that $14 + 40 = 54$ is the equivalent or relative weight of an atom of aqua-fortis. It is colourless, and has a specific gravity of 1·51. If 58 of it and 42 of water are mixed, the volume is but 92·65, and the temperature rises from 60° to 140°. It rapidly liquifies snow, and generates great cold. It boils at + 248, and freezes — 50.

Vitriol, or *sulphuric acid*, is 1 proportional of sulphur 16. + 3 of oxygen 24. + 1 of water 9, = 49. The volumes are 100 S. and 150 O. Its specific gravity is 1·847, and it boils at 620° and freezes — 15°. Its oily character gave it the name of oil of vitriol.

Acetic acid, or distilled vinegar, is composed of oxygen 44·147; hydrogen 5·629; carbon 50·224.

Oxalic acid is composed of oxygen 70·689; hydrogen 2·745; carbon 26·566.

Tartaric acid consists of oxygen 69·321; hydrogen 6·629; carbon 24·05.

Citric acid, or juice of lemons, consists of oxygen 59·859; hydrogen 6·33; carbon 33·811.

Gallic acid is carbon 56·64; hydrogen 5; oxygen 38·36.

Acids and alkalies are, to each other, like negative and positive; and, when mixed in equal proportions, neutralize each other; and, when neutralized, are in equal proportions saturated.

The principal *alkalies* are Ammonia, and its carbonate, muriate, sulphate, and acetate. Potash, and its carbonate, sub-carbonate, sulphate, bi-sulphate, nitrate, oxalate, tartrate, prussiate, and chromate Soda its carbonate, *sub* and *bi;* sulphate, nitrate, muriate, and borate.

Alkalies have the power of changing the blue vegetable juices to green, the green to yellow, the yellow to orange, orange to red, and red to purple. Chlorine destroys vegetable colours.

100 of pure potash are equal to 70 of concentrated sulphuric acid, and thus they are mutual tests.

The volatile alkali found as sulphate and muriate exists, which, when separated, is a compound of hydrogen 1·76, and nitrogen 98·24.

The only difference in the two alkalies is, that the fixed is a compound of oxygen and nitrogen; and the volatile of hydrogen and nitrogen. When separated, the oxygen of the air burns them by a rapid union.

Potash, or fixed vegetable alkali, is procured from the ashes of vegetables exposed to the air; it runs into liquid, and is very acrid and corrosive. Its specific gravity is 1·7.

Potassium is formed by exposing an hydrate of potash to a voltaic circle of 500 double plates of four inches, when the substance appears at the negative pole, oxygen being developed at the positive pole. It is also made by melting potash with iron turnings in a gun-barrel. It is solid nitrogen or hydrogen.

Soda is a mineral alkali, but may be procured, like potash, from ashes. Its specific gravity is 1·34.

Lime, or limestone, usually exists in combination with carbonic acid, which may be expelled by heat in a kiln, and we then get pure, or quick-lime, which absorbs and fixes water 1·25 to 3·5 lime, with heat.

Gypsum, or sulphate of lime, is 33 lime, 44·8 sulphuric, and 21 water. It forms beds and strata in secondary formations. When used for casts, &c. it is called Plaster of Paris, large gypsum beds filled with fossil remains existing near Paris.

Slaked lime, is called an hydrate of lime.

If lime-powder, from which the carbonic acid has been expelled, be exposed to the intense heat of the union of oxygen and hydrogen at the poles of a voltaic battery, or at the current of a blow-pipe, it is converted into *calcium*, and during the combustion gives out so much light that a small piece or pea of it may be used in light-houses, and in microscopes, instead of solar light. And for this last purpose, chalk exposed to the hydro-oxygen blow-pipe answers equally well.

Lime-water renders vegetable blues, green; yellows, brown; and reds, purple.

Pure lime mixed with sand and water, forms mortar; which, imbibing carbonic acid from the atmosphere, becomes limestone again, and thereby cements walls of brick and stone.

Combinations of lime with sulphur and phosphorus, are considered as combinations with the calcium, or base of the lime, and, hence, they are called sulphurets and phosphurets of calcium.

The chloride of lime, or oxymuriate of lime, is formed by passing chlorine over slacked lime, or by drying muriate of lime. It is the bleaching powder used to decompose colouring matter in fabrics, by absorbing the hydrogen. In manufactories the chlorine is produced by half a ton each of salt and manganese, with 2-thirds sulphuric acid (1·65), and this saturates as much slacked lime as yields a ton and a half of bleaching-powder. An ounce in a gallon of water is also used as a means of absorbing the hydrogen in odours, and in infectious air, by sprinkling.

Sulphate of lime is gypsum, and phosphate of lime is 86 in 100, of all animal bones, and itself 55 lime, 45 phosphoric acid.

The crystal of carbonate of lime is an obtuse rhomboid of 105°·5 and 74°·55; and there are 600 varieties of this rhomboid.

Gypsum, or sulphate of lime, has its crystals 113° 8 and 65 52.

100 of Epsom salt, or sulphate of magnesia, yields 16 of pure magnesia when heated with 56 and 44 of the sub-carbonates of potash and soda. Carbonate of magnesia, calcined, is the pure earth anti-acid and cathartic.

SALTS are compounds of acids with alkalies, earths, and metallic oxides. Thus, there are muriates from muriatic acid, fluates from fluoric acid, borates from boracic acid, and phosphates from phosphoric acid, sulphates from sulphuric acid, carbonates from carbonic acid, nitrates from nitric acid, oxymuriates from oxymuriatic acid, arceniates from arsenic acid, oxalates from oxalic acid, tartrates from tartaric acid, prussiates from prussic acid, &c. &c. besides phosphites, sulphites, and nitrites, from *lower* degrees of acidity.

All *salts* consist of an acid and metallic oxide. Commonly, however, the protoxide is the salifiable base. Those oxides soluble in water give a brown stain to yellow turmeric paper, and restore the blue of reddened litmus.

All the metals are formed into *Salts*.

Thus, there is muriate of gold, which, with tin, makes the purple of Cassius.

Nitrate of silver, called lunar caustic.

Nitrate of copper, which detonates.

Acetate of copper, called verdigris.

Sulphate of zinc, called white vitriol.

Tartrate of potash and antimony, called tartar-emetic.

Muriate of cobalt, which is sympathetic ink, being without colour when cold, but turning green when held to the fire.

Super-oxalate of potash and extract of sorrel is essential salt of lemons.

Antimony and chloric gas form butter of antimony.

Salt of sorrel, or super-oxalate of potash, is what is called *Salt of lemons*. It dissolves the oxide of iron in the ink.

Salt of tartar remains dry at the top of very high mountains, though it liquifies at their base.

Salt cracks in the fire, owing to water in it being vaporized.

All cattle thrive best if supplied with *Salt*. Horses will consume 6 oz. daily, cows 4, and sheep ½, and do not rot.

Unknown *Salts* are determined to be nitrates by mixing them with muriatic acid, when chlorine is evolved.

Muriate of ammonia is *Sal ammoniac*.

Carbonate of potash is *Salt* of worm-wood.

Smelling *Salts*, or carbonate of ammonia, are formed by carbonic acid gas, mixed over mercury with gas from quick-lime and sal ammoniac. Combined with water, it is spirits of hartshorn.

Lightning produces nitric acid.

The facility with which nitric acid yields its oxygen, enables it to oxidate metals, especially tin, copper, and mercury, and it rapidly decomposes vegetable and animal substances. It parts with three of its doses, and becomes deutoxide of nitrogen, and even light carries off one dose. As it loses its oxygen it changes colour, from light yellow down to blue.

Aqua regia is one measure of nitric acid and two of muriatic acid, and dissolves gold and platinum.

Alcohol consists of oxygen 37 85; carbon 43·65; hydrogen 14·94; azote 3·52; ashes 0·04.

Sulphuric ether consists of carbon 58·2; hydrogen 22·14; oxygen 19·66.

Nitric ether consists of oxygen 48·52 carbon 28·45; azote 14·49; hydrogen 8·54.

Muriatic ether consists of muriatic acid 29·44; carbon 36·61; oxygen 23·31; hydrogen 10·64.

Carbonate of magnesia is 48 magnesia, 49 carbonic acid; and 3 water.

Sugar, 37½ to 43½ of carbon; 6½ to 7 of hydrogen; 50½ to 55½ of oxygen. *Sugar* crystallizes in rhomboid prisms. Starch boiled with much water, and some sulphuric acid, becomes sugar in some hours.

Fermented sugar and water is 57 parts alcohol and 43 carbonic acid.

Sugar, per Berzelius, is 7 hydrogen; 44 carbon; and 49 oxygen.

Olive, or *table-oil*, contains carbon 77·213; oxygen 9·427; hydrogen 13 36.

Wax consists of carbon 81·784; hydrogen 12·672; oxygen 5·544.

Rosin consists of carbon 76; oxygen 13; hydrogen 11.

Copal consists of carbon 77; oxygen 11; hydrogen 12.

Oak wood contains oxygen 42; carbon 52; hydrogen 6.

Beech contains oxygen 43; carbon 51: hydrogen 6.

Tannin, per Berzelius, is carbon 52·65; hydrogen 3·85; oxygen 43·5; or 21 atoms carbon; 9 hydrogen; 13 oxygen.

Indigo is 16 atoms carbon; 4 hydrogen; 1 azote; and 2 oxygen.

Lignum, or woody fibre, is carbon 50; hydrogen 5·55, and oxygen 44·45. (The two last as in water.)

Wool is 12·3 azote; carbon 53·7; hydroged 2·8; oxygen 31·2.

Yellow Silk consists of 53·37 of filament; 20·66 of gelatine; 24·43 of albumen; and *White Silk*, 1 less gelatine. There is also 1·25 cerine.

Tin Pyrites contain sulphur 29·64; tin 25·55; copper 29·53; iron 12·44; zinc 1·77.

Wheat and barley contain as under:—

	wheat	*barley*
Silica	13·2	66·7
Carbonate of lime	12·6	24·8
Carbonate of magnesia	13·4	25·3
Alumina	·6	4·2
Oxide of manganese	5·0	6·7
Oxide of iron	2·5	3·8

The quantity of each being 2 lbs.

One-twelfth of wheat is gluten, which consists of oxygen, hydrogen, azote, and carbon. The gluten varies.

Autumnal wheat contains 77 starch, 19 gluten. *Spring* wheat, 70 starch, 24 gluten.

Oats contain 144 2 silica.

Rye straw 152 silica.

Starch contains 38½ to 45 of carbon; 6 to 7 of hydrogen; 48½ to 55 of oxygen.

Potato starch consists of 49·455 oxygen; 43·481 carbon; 7·064 hydrogen. This would make sugar at 3*d*. per lb.—*Day*.

Rochelle salts consist of 55 tartrate of potash; 45 tartrate of soda.

Sea-water contains ·135 of muriate of soda; ·004 of muriate of magnesia; ·0025 of Epsom salts; ·00125 of gypsum. It obstructs all light at 120 fathoms.

Alcohol is the spirit of wine obtained from the distillation of fermented liquors, and from wine is called brandy; from the sugar-cane, rum; from malt or grain, whiskey and gin. The different flavours arise from the quantity of oil or resin, the bases being alcohol and water. Further distillation produces rectified spirits, the specific gravity of which is about ·85; but, by further rectification, it may be carried to 0·795.

Pure alcohol is quite colourless and transparent; it never freezes, but evaporates spontaneously, boiling at 173½°. Proof spirits are 0·92. When the gravity is higher, they are under proof; when lower, above proof. Perfectly pure alcohol is about 0·74. The flame is blue, and it leaves no residuum. The vapours consist of carbonic acid and water, and the bulk of water is greater than the alcohol.

BRANDE's analyses of the quantity per cent. of alcohol, or pure spirit, in the following liquors, give:—

Scotch whiskey	54·32
Irish	53·9
Rum	53·68
Brandy	53·39
Gin	51·6
Port	22·9
Madeira	22·27
Currant	20·55
Teneriffe	19·79
Sherry	19·17
Claret	15·1
Champagne	13·8
Gooseberry	11·84
Elder	8·79
Ale	6·87
Porter	4·2
Cyder	9·8 to 5·2

During the combustion of 16 oz. of alcohol, water of greater weight is produced, and also carbonic acid.—Alcohol from 30° to 100° expands a 25th. but water only the 145th. At 60°, standard alcohol is 825. Gilpin, secretary of the Royal Society, Dollfus, and Blagdon, in 1789, performed a most elaborate series of 280 experiments, 3 times over, on the specific gravity of alcohol from 30° to 100°, with mixtures of 15 water from 5 to 100, in 100 quarts of spirit, and then 100 of water to 95, down to 5 of spirit. At 30°, the spirit was ·83896; at 40°, ·83445; at 50°, ·82997; at 60°, ·82500; at 75°, ·81780; at 90°, ·81044; and at 100°, ·80548; being a difference of ·3348 in 70° of heat. At 60°, 25 of water raised the specific gravity to ·86918; 50 of water to ·89707; 75 to ·91622; and 100, or equal spirit and water, to ·93002, the true mean being ·9125 At 30°, equal quantities gave ·94222, and at 100°, they gave ·91310.—50 of spirit to 100 of water, at 60°, gave ·95804; and 5 of spirit to 100 of water, at 80°, gave ·98991.

Burnt with care, the product of the alcohol was water, and an 8th more; and in closed vessels, in oxygen, the product was water and carbonic acid; proving that alcohol is carbon and hydrogen.

1000 grains of brandy, evaporated to dryness, gave 40 of residuum of foreign substance, but in rum only 8½.

Pyroxylic spirit is carbon 54·88; hydrogen 11·27; oxygen 33·85.

The vapour of naphtha is 10 carbon and 5 hydrogen, and its sp. gr. 4·528.—*Laurent*.

100 parts of cream, specific gravity 1·0244, contain 4·5 of *butter*; caseous matter 3·5; whey 92.

1000 parts of *milk*, specific gravity 1·033, contain water 928·75; caseous matter 28; sugar of milk 35. The remaining 8·25 acid, alkalies, and iron.

Cream is the lighter unctuous part of milk, which rises to the top; and, by churning, it is further separated into butter and butter-milk. Milk, when sour, may be fermented; and it will yield a vinous liquor; and also take the acetous fermentation. Its constituents are water, oil, curd, gelatine, sugar of milk, muriates of soda and potash, phosphate of lime and sulphur. The cream is thickest in the milk of the cow, goat, and ewe. In women and asses it is whiter and thinner, affording less cream and soft butter. Mares' milk is like cows', but it affords less cream and poor butter.

The curd of cheese consists of 60 carbon; 11 oxygen; 7 hydrogen; and 22 nitrogen.

In an *egg* of 1000 grains, the shell is 106·9, the white 604·2, and the yolk 288·9. The shell is 97 carbonate of lime, and only 2·2 of animal matter.

The blood of man contains (according to Berzelius) less than half saline ingredients; yet it is neither darker nor more difficult of arterialization.

The only difference between the blood of cholera and of health consists in a deficiency of water in the serum, and a consequent excess of albumen.

The saline ingredients of the serum are the same as in healthy blood; and the want of fluidity in the blood, the darkness of its colour, and the bulk of the crassamentum, are simple effects of the increased viscidity of the serum.

Particles of blood are considered to be two million times greater than particles of water.

Gunpowder, as made by the English government, is 75 of nitre; 10 of sulphur; 15 of charcoal.

In France, the proportions are, 77 of nitre; 9 of sulphur; 14 of charcoal.

The solid contents are, 40 grains of sub-carbonate of potash; 11 of sulphate of potash; 3 of charcoal; ⅓ of sulphur.

The *charcoal* used in gunpowder is distilled in iron vessels, from willow, alder, and some other woods.

The gaseous products of 100 grains are 91 cubic inches, and the solid products 54 grains. The gases are, azote 42 inches; carbonic acid 30 inches; carburetted hydrogen 9; sulphuretted hydrogen 4; nitrous gas 6;—making 91. Original bulk to gaseous, 1 to 364.

100 parts of oak make 22 of *charcoal*; of beech, 20; of deal, 19, glossy black; of elm, 19½, black; of ash, 18, glossy black; birch, 17, rich black.

100 parts of shavings of dry wood produce one-fourth of *charcoal* by slow combustion.

Glass is formed by combining, in a state of fusion, fixed alkalies with silica, and the occasional addition of litharge, oxide of iron, or manganese. That called flint-glass is made of fixed alkalies, calcined flints, and litharge or oxide of lead. Ground-glass is made of fixed alkali, and siliceous sand, with oxide of iron for a green tinge, or oxide of manganese for a purple tinge. Bottle-glass consists of lime fused with silica and alumina, with iron and manganese.

Flint-*glass* is generally made of 100 sand, 6 red-lead, and 3 pearl-ash, with some manganese to correct the green colour.

Plate-*glass* is made of 43 sand, 26·5 subcarbonate of soda, 4 quick-lime, 1·9 nitre, and 25 broken glass, which makes 75 of glass.

Crown-*glass* is made of 50 sand and 110 kelp.

Bottle-*glass* is made of soap-boiler's waste and river sand; or of sand, lime, clay, and sea-salt.

Oxide of cobalt tinges *glass* green; oxide of iron or copper, green; of manganese, violet; of iron and copper, red; of gold, purple; of silver, yellow; and of arsenic and zinc, white.

The real quantity of alkali contained in the substances used in bleaching, of 100 parts, is:—

American pearl-ashes ..	60 to 73
Russian pearl-ashes	52 to 58
White Dantzic do.	45 to 52
Alicant barilla...........	20 to 33
Natron	20 to 30
Salt of tartar	72
Common salt	53

Salt-cake, black ash, or British barilla, is a mixture of sulphuric acid with salt. The manufacture is found to be pernicious to vegetation, metals, and animal life.

Albumen is an animal substance, of which the white of an egg is an example. It becomes a white coagulate at 165 deg., or if corrosive sublimate is united to it. It contains 53 carbon; 24 oxygen; 7 hydrogen; 16 nitrogen.

Mucilage, 36 to 45 of carbon; 5½ to 7 of hydrogen; 48 to 55 of oxygen.

Arabin, the greater portion of all gums, is, carbon 43·81; oxygen 49·85; hydrogen 6·2; azote ·14.

Indigo is 73 carbon; 4 hydrogen; 10·8 nitrogen; and 12·2 oxygen.

Porcelain earths have from 43 to 61 silica, from 24 to 40 alumina; 1 to 3 of magnesia; and 11 to 14 of water. Cornish has but 39·55 silica; 38 alumina; 1·5 magnesia; with 12·5 water and 8·7 insoluble.

The *Brain* consists of the following constituents:—

Water	80·
White fatty matter ..	4·53
Red ditto	0·7
Albumen	7·
Osmazome	1·12
Phosphorus	1·5
Salts and sulphur	5·15

15 lbs. of *Bone* contain 6 lbs. of gelatinous substance. Every 100 lbs. of meat has 15 lbs.

Oil and *fat* are compounds of carbon, hydrogen, and oxygen. Fat consists of two substances, one which melts at 50 deg. and the other at 105 deg.; the former oil, and the latter suet. Butter made in summer contains 60 of oil, and 40 of suet; but in winter 37 of oil, and 63 of suet. Goose-grease contains 68 of oil, and 32 of suet.

Some oils have been imported from China, worthy of that ingenious people, and far superior for every purpose to our odious whale and sperm oils, and our animal fats. They express *Tea-oil* from the seeds of that plant, and, perhaps, from all camellias by the pressure of wedges in cylinders. Its specific gravity is 0·927, and it consists of oxygen 9·852, carbon 78·619, and hydrogen 11·529, *i. e.* O + 10·25 C + 9·25 H, or 1 carbonic oxide, and 9·25 carbi-hydrogen. It is very cheap, about 1s. a quart, and is used for light and for the table, both by rich and poor. Minia Batta is an oil solid below 70°, and mixed by the Chinese with wax for candles, and with rice as food. With alkalies it makes excellent soap. It contains 0·5 carbon and hydrogen more than tea-oil. Candle-tree, or croton sebiferum oil, is another elegant Chinese product mixed with other substances for domestic lights.

Oils have also been expressed from grain, potatoes, the bard-cherry, and many other vegetables. The best burning oil, in Europe, is that purified at Paris, and sold in London under the name of Vegetable oil. The best table-oils are those expressed from olives in Italy, but sold very dear in London.

Oils and fats contain two acids, the margaric and stearic, and hence their decomposition by alkalies.

The *perspiration* from an animal body consists of water, carbonic, acetic, and phosphoric acids and soda.

One carbonic acid, 10 carburetted hydrogen, and 20 of hydrogen, passed through a red-hot tube, form *fatty* and *greasy* matter.

Urine contains no less than twelve acidulous combinations, besides sulphur, resin, urea, albumen, and water, when healthy; but, in disease, other urinary calculi contains six acidulous combinations, besides magnesia. Silica and urea, uric acid, phosphate of lime and magnesia, and oxalate of iron, are the principal.

Animal substances, besides the principles of vegetables, contain much nitrogen, with a little sulphur and phosphorus, and their compounds with carbon.

According to Gmelin, 800 parts of *Bile*

consists of 700 water, 15 resin, 69 picromel (the sweetish bitter matter), 4 yellow matter, 4 soda, 4 phosphate of soda, 3·5 muriates of soda and potash, some soda, lime, and magnesia, and a little oxide of iron.

Attraction and *repulsion* are as false in chemistry as in general physics, since neither atom, nor mass, can push another atom or mass towards itself by any impulse from the opposite side, where it is not present; and in pretended repulsion, as a body is only in force in the direction in which it is moving, so a body moving from another cannot make the other move the contrary way. All attractions and repulsions are, therefore, resolvable into external or atomic actions, of which the bodies are patients.

Cohesion arises from the smallness of fitting, or similarly-shaped atoms. It varies as they are compounded. It is best destroyed by sufficient percussion or vibration, or by the atomic motion of heat.

Affinity, in fluids and gases, arises from the varied mobility of different atoms; and from the varied re-actions of the medium in which the bodies are placed. Chemical affinity takes place when bodies are resolved into their fundamental molecules, either in the fluid or the gaseous state. There is no affinity displayed, except the atoms are in one of these states. Faraday asserts, that chemical affinity is merely a result of the electrical states of the particles, and that composition and decomposition of bodies may be effected by electricity.

Chemical combinations change the relative properties of bodies.

If the solids and pores are equal, and the solids made up of other such pores, then, in three degrees, the solid would have seven times more pores than solid matter; and, in a fourth degree, fifteen times more pore than solid.—*Newton.*

As every body, moved in a right line, and continually re-acted upon, is necessarily turned into a circle, so there is no difficulty in perceiving that every atom, projected with velocity into a medium of atoms, is necessarily turned into an orbit, greater or less as the force of projection, or the intensity of atomic motion called heat. Such, then, is all steam and gas, though the enlarged space has been very absurdly ascribed to repulsion. When reduced in bulk the orbits are reduced, and their motions or heat imparted to other bodies around. When increased in bulk they acquire motions or heat from surrounding bodies.

What is called chemical attraction may be a mere variety of motion co-extensive in the same space, as vertical, concentric, &c. &c. for every equal space has equal power, or attains it, having more matter and less motion, or more motion and less matter, as a primary and universal law, a law of nature.

The solution of fixed bodies by fluids arises from the atomic motions of the fluid, and as these are increased by heat, or more motion, the solution is more rapid. A lump of dry alum is thus dissolved in half the time in water at 80 deg., and in a fifth at 120 deg. Fluids of the same degree of motion mingle at once, others in longer time; and some give out, and some absorb heat in mixing. Motion is, of course, opposed to cohesion, and its withdrawal favourable to fixity. This is the repulsion and attraction of modern theorists.

The solution of solids always absorbs heat or atomic motion, and their resolidification gives it out. Fluids have also to dissolve one another, and hence produce heat or cold, as the resulting volume is less or more. Some atoms become fluid or gaseous sooner or later than others, and some fluids and gases have more or less motion in the atoms which compose them, and these circumstances create most of the phenomena of chemistry.

The most popular phenomenon of this science is *Combustion*. It is a case of decomposition and re-composition, and the intermediate effects or accidents are heat and light. A combustible body contains hydrogen and carbon. The air, in which the combustion takes place, consists of oxygen and nitrogen, and, if a definite bulk of air is employed, the oxygen disappears, and may be found in the products of the combustion. It is necessary to affix a precise idea to *gas*—which, in a word, is atoms in intense orbit motions, resulting from a primary force in right lines, and the re-action of other atoms in the space. Oxygen then consists of such atoms, and, of course, if they are fixed, they transfer their momenta to the bodies fixing them. If to atoms of hydrogen, they condense as water, with heat to surrounding bodies; and if to carbon, they form carbonic acid, with surrounding heat.

Combustion is begun by applying heat or excitement, as lighted paper or a taper to the combustible. This melts the tallow or wax, and raises into excitement the latent hydrogen, that is, it forms orbits too large for the space; and a vacuum is created, which the oxygen fills with 8 times the force, becoming fixed by the hydrogen, both in atoms of water and by the carbon in carbonic acid. The oxygen is thus fixed, and the air so far decomposed; but the fixation at the wick raises an intense local heat, which, unable otherwise to escape, acts on the atoms of air, and creates in them a general propulsion which we call light, the heat being the concentrated motion at the spot.

Berzelius considers combustion as exactly akin to electrical restoration. Lavoisier's theory is derived from Black, and supposed gratuitously to be the extrication of the imponderable poetical element called caloric.

Others call combustion *the process of the solution of a body in oxygen*, as happens when sulphur or charcoal is burnt.

Of course, no substance is destroyed or annihilated by *combustion;* the parts are merely separated, and formed into *new combinations*, and there is no caloric or matter of heat, but merely a transfer of atomic motion.

As heat and light in combustion are caused by the concentration of oxygen, or by

the fixation of its previously-*moving atoms*, so whatever means are used, or can be used to fix oxygen, must be likely to produce local heat, and the re-diffusion of its action in light. The discovery of these means, and of all the means, is, therefore, the grand desideratum of experimental philosophy in this and the next age.

Bisulphuret of carbon, a yellow solid, and a black solid, forms a transparent fluid, so volatile, that no cold will crystallize it.

Ten cubic inches of zinc and 10 copper combine as only 10 of brass.

Sodium, pure nitrogen or hydrogen, flames in oxymuriatic gas, (chlorine,) and forms salt, which, therefore, is a compound of hydrogen, oxygen, and muriatic acid.

100 lime absorbs 78·5 carbonic acid, and forms chalk, marble, &c. 100 of potash absorb 46 of carbonic acid, and by pressure 46.

Carbonic acid gas is one dose of carbon, 37 to 100; but another dose of 37 is carbonic oxide, of totally different properties.

Muriatic acid being resolvable into hydrogen and chlorine, is often theoretically called *hydrochloric acid*, while chlorine itself is another compound of oxygen, and the pure alkali sodium.

The ancient chemists distinguished bodies into acids, alkalies, and neutrals; the moderns into oxygen, nitrogen, hydrogen, and carbon, neither of which are exactly synonimous with the other.

Vegetables are compounded of oxygen, hydrogen, carbon, and some azote. Animals of oxygen, azote, hydrogen, carbon, phosphorus, and lime.

A man generates nearly a cubic foot of carbonic acid per hour, by which he gives off half an ounce of carbon, and the conversion of oxygen gives out the precise quantity of animal heat, in the difference of the specific heat of both.

Though the phenomenon of common combustion is owing entirely to oxygen combining with hydrogen and carbon, yet chlorine supports the flame of phosphorus, and for a short time a burning taper; so also potassium burns in cyanogen, and heated copper-leaf, or iron-wire, in vapour of sulphur.

When chemists try to form gums, or sugar of oxygen, and carbon, they get water and carbonic acid.

Gases mix equally, and, when mixed, do not separate. Dalton ascribes this to the particles being of different sizes. And, gases of different gravities become uniformly diffused by mutual absorption. Hence, hydrogen is not generally uppermost in the atmosphere, nor carbonic acid undermost.

A pressure of 1700 feet of water, or 600 of lava, is sufficient to prevent the gasification of carbonic acid.

The most intense artificial light is produced by the union of positive and negative electricity on charcoal in a *vacuum*. The positive is, therefore, to be regarded as the supporter of combustion or oxygen; the negative as the patient, or hydrogen; and the carbon as the atoms unconsumed or electrified. Then, as all light is produced by the same elements, are we not justified in asserting, that light from combustion and from electricity are identical?

Nitrates of lime and magnesia imbibe the moisture of the air, and become liquid.

Forty parts of sea-salt unite with 100 water, and no more, it appearing that no more of the interstices of the water admit atoms of the salt to move among them.

The clergy were the steady pursuers and patrons of *Alchemy*. Its signs and mystic combinations are found in most of our cathedrals and older churches. For 600 years it was an authorized science, and secretly practised only when the people suspected an intercourse with the devil. The Benedictines and Abbots of Westminster had great fame in these pursuits. Abbot Cromer introduced Raymond Lully to Edward I., and the Alchemists tell us he supplied that prince with six millions of gold. Flammel, in the same period, was figuring in Paris. Geber, Muller, Dee, Boyle, and even Bacon and Newton lent themselves to this infatuation. The last were Peter Woulfe, a very scientific chemist, John Kellerman, and Dr. Wilkinson, of Enfield—while Davy's doctrine, that all earths are metallic oxides, revived the pursuit.

Alumina, or *Argil*, and oxides of iron and tin, are the *mordaunts* or bases used in dyeing, whose affinity for the material coincides with that for the adjective colour. They are used with sulphuric acid, and the protomuriate of tin. Indigo, in connection with sulphuric acid, gives blue colours. Archil, madder, &c, red ones. Quercitron, turmeric, &c. yellows. Oxide of iron, and gallic acid, blacks. Other colours are compounds of these.

The best crucibles are Hessian or Cornish. Vessels and tubes of glass bear the greatest internal expansive force. One ten inches thick has stood a compression of 135 atmospheres.

The most expansible of all substances is a mixture of chlorine and ammonia, called *Detonating Oil*, or chloride of nitrogen. It is an absorption of chlorine gas, by the nitrogen of the ammonia, at 60° or 70°; and a single grain of it is equal to a barrel of gunpowder. It is 1 nitrogen + 4 chlorine, equiv. 158, or, per Brande, 147.

Turner, after a very accurate analysis, determines that it is erroneous to make hydrogen an aliquot part, and that lead is truly 103·5, silver 108, chlorine 35·43, and nitrogen 14 or 14·1.

By Dr. Paris's table, it appears that 10° of the acitometer is 4°73 of real acid, with power of 14·5 grains of sub-carbonate of soda, to saturate 100 acid. The equivalent 480. At 50° it requires 72·5 of soda; at 60°, 87; at 75°, 108·75; at 145°, 210; and at 167°·5, 243; the real acid in the two last being 68·5 and 79, and the specific gravity 1·07 and 1·063.

The remains of distilled coal are *coke*, and those of wood are *charcoal*; both of them *carbon*, of different compactness.

Light matches are made of three parts of chlorate of potash and one of sulphur or sugar, made into paste with gum-water

The matches are dipped in this paste, and, when touched with sulphuric acid in a bottle, they flame.

The ingenuity of chemists has extended analysis, of late years, to the discovery of the *proximate principles*, or concentrated alkalies of most of the powerful products of the vegetable world. They display most of the usual properties of potash and soda, and possess the powers of the substance whence they are derived in a 10th, 20th, or 40th of the original bulk. In their medical use, we arrive at once at the operative principle, to recombine as we think proper.

MORPHINE, from opium.
QUININE, from yellow bark.
CINCHONIA, from red bark.
BRUCINE, from Angustura bark.
STRYCHNIA, from nux vomica.
PRUSSIC ACID, from bitter-almond rinds.
VERATRIA, from hellebore and colchicum.
GENTIA, from gentian-root.
CATHARTINE, from senna.
EMILA, from ipecacuanha.
PIPERA, from black pepper.
ATROPIA, from Belladona.
NICOTIN, from tobacco.
SOLANA, from the solanum nigrum.
HYOSCYMA, from henbane.
&c. &c. &c.

Geiger divides the organic alkalies into volatile and fixed. Volatile organic alkalies volatilize at the ordinary temperature, and in their state of greatest purity they are liquid, and are always distinguished by a peculiar odour. Those not volatile at the ordinary temperature are solid, not alterable in the air, and when they are very pure, inodorous. *Hyosciamine* forms, as it were, the transition between the organic volatile and fixed alkalies.

Physiologically, they may be divided into the noxious and the innoxious. All the volatile organic alkalies are acrid and poisonous. Among the fixed *atropine*, *hyosciamine*, *daturine*, *colchicine*, *aconitine*, also *delphinine* and *emetine*, are acrid, or bitter, and poisonous. *Morphine*, *strychnine*, and *brucine* are bitter, narcotic, and poisonous. Quinine and cinchonine belong to the class of organic fixed alkalies, which are bitter and not poisonous. All the organic bases contain nitrogen; and verify the remarkable law discovered by Liebig, that the proportion of nitrogen gives the measure of their saturating power. An atom of an organic alkali contains exactly an atom of nitrogen.

Pelletier and Caventou obtained *cinchonia* from the grey bark *(cinchonia condaminea)*; *quinia* from yellow bark *(cinchonia cordifolia)*; the red bark yielded *cinchonia* like the grey bark, but in three times the quantity; and *quinia* in nearly double the proportion found in the yellow bark. Both alkaloids exist in the three species of bark.

Manipulating chemists, especially the Germans, continue to add to the number of analyses. Thus every year add new acids, and new alkaloids, without increasing the utility of chemistry.

Alphabetical arrangement of some substances, facts, &c.

Acids change purples and blues to red.

Alkalies change blue vegetable colours to green, and brown to yellow. There are three, potash, soda, and ammonia. They unite with acids and form neutral salts, and with oils form soap.

The strength of liquid *acids* is determined by the hydrometer; and of dry *acids*, by neutralizing subcarbonate of soda, or carbonate of lime.

Alum, or sulphate of alumina, is a salt used as a mordaunt in tanning, to harden tallow, and in whitening bread. It may be made of pure clay, exposed to vapours of sulphuric acid, and sulphate of potash added to the ley. But it is usually obtained by means of ore, called alum slate.

Amalgam is quicksilver combined with metal, generally tin, or tin-foil.

Ammoniacal gas, passed through burning charcoal, becomes *Prussic acid*; and, when combined with oxides of gold or silver, it renders them fulminating.

The fluids of *Animal* bodies, in their chemical properties, are watery, albuminous, mucous, oleaginous, resinous, saline, gelatinous, and fibrinous. Of these, the solids are continued secretions in laminæ, and fibres or filaments, or tissues.

Argol, or archil, is a colouring substance obtained from *lichens*, used by dyers to improve other colours. It is brought from Elba and the Levant.

Arnotta is a dye, derived from the seeds of the Bixa, a South American tree.

Arrack is made from the juice of the tops of cocoa-nut and palmyra-trees. At Batavia it is made from *paddee*, rice in the husk.

Arrack spirit is distilled at Java from 62 parts of molasses, 35 of rice, and 3 of toddy or palm-wine. In other parts of Asia the substances vary, and toddy is used alone.

A species of Leptomitus, or hygrocrocis grows, and is formed in solution of *arsenic*.

About 20 *alloys* increase density, and 15 diminish it. Gold and tin, silver and tin, increase in density; but gold and silver, and gold and copper diminish, so silver and copper, iron and lead, and tin and lead.

Sulphuret of *antimony* is used in pharmacy, and called *antimony*, while the metal is the regulus.

Artificial teeth are made of the tooth of the sea-horse, harder than ivory.

Balloons are filled with carburetted hydrogen gas, and by the Gas Companies for about 5*l*.

Nitrate of lime is *Baldwin's* phosphorus.

Bell-metal is three of copper and one of tin.

Blende is a native sulphuret of zinc.

Bleaching is effected by chlorine gas, and finished with lime.

Bones consist of phosphate of lime chiefly, with carbonate of lime, phosphate of magnesia, and sulphate of lime, and also of gelatine, fat, and cartilage.

The froth of warm beer, &c. is caused by

the escape of air, which is expanded by the heat.

The blood, reacted on by different organs, produces milk, bile, urine, &c.

Bitumens are carbon and hydrogen, or naphtha and asphaltum, or petroline, 88·5 carbon, and 11·5 hydrogen; asphaltum a black oxide of petroline.

Bronzing is a wash by a composition made by grinding gold-leaf with honey, which is washed from the gold with water; or, it is made by combining sixteen parts of tin, eight of mercury, eight of sal ammoniac, and seven of flour of sulphur. Red lead gives it a copper shade. There are other preparations for bronzing different substances.

Bromine is obtained from sea-water and the ashes of sea-weeds. It is red, poisonous, and very volatile.

Butter melts at 96°. It is formed by the act of churning, and is not suspended or diluted in the cream, but is generated by contact with the air or some peculiar combination.

Forty grains of mercury, and ten and a half of chlorine gas, form *Calomel*.

Camphor, *potassium*, *&c.* rotate on water, owing to the evaporation and solution.

Carmine is made from cochineal.

Carbonate of soda is formed by passing a current of carbonic acid into a solution of soda, and it becomes a hard mass. Its crystals are octahedrous, with prismatic apexes. Carbonate of potash is made like the other, with potash instead of soda.

Caoutchouc, or Indian rubber, is formed of a gum, which exudes by incision from two plants which grow in Cayenne and the Brazils, called *hævia caoutchouc*, and the *jatiopha elastica*; the resinous substance, as it hardens, being formed round clay moulds. The *urceola*, which grows in the Indian seas, also affords this gum, as well as some other plants. Its specific gravity is 0·9335. It is very inflammable; when distilled it gives out ammonia, water, oil, and charcoal. In South America they make bottles with it; and, in London, it forms an infinite variety of articles, useful in clothing, surgery, and manufactures.

The volatile oil of Caoutchouc has a specific gravity of 0·666, and boils at 90°.

Berzelius states, that many bodies, simple and compound, soluble and insoluble, exert actions on other bodies, different from chemical affinity. They produce decompositions and compounds, without being incorporated. He calls it the power of presence, or *Catalysis!*

White oxide of lead is *Ceruse*.

Carbonate of lime is *Chalk*, marble, &c.

Four pounds of chalk, and 5 pounds of moist blue clay, confer an adhesive power on a brick of 5000 pounds. Hydrate of lime with clay (arising from the metallic oxide) fires under water. Puzzolana, Dutch terras, and basalt, contain oxide of iron. The oxides under water effect the purposes of carbonic acid in air.

Chloride of sodium and chloride of lime are extensively used to destroy fetid or impure odours. Chloride of sodium, in the proportion of one part to ten or fifteen of water, is applied to carbuncles, hospital gangrene, cancerous or ill-conditioned ulcers, corrosive tetter, diphtheritic sore throat, and to burns.

Chocolate is a preparation from the cocoa-nut, which is ground into powder with lard, made into cakes, and flavoured with spices.

Twenty-one cubic inches of chlorine gas, and forty grains of mercury, form *Corrosive sublimate*.

Corrosive sublimate is at length acknowledged to be a cure for dry-rot, and extensively applied by Kyan.

Relics of *Cider* casks are readily converted into good vinegar, by air, sun, and stirring, and by the addition of about the 100th part of pyroligneous acid.

Green oxide of *Copper* is the rust of copper.

Acidulous tartrite of potash is *Cream of tartar*.

One part of mercury, and two of sulphur, become *Æthiop's mineral*, now called sulphuret of mercury. When this is exposed to a red-heat, with a double portion of sulphur, it forms *Cinnabar*, which consists of 85 parts of mercury, and 30 of sulphur.

Decrepitation arises from water and cleavage.

Disinfection is effected by mixing half an ounce of muriatic and nitrous acid in a quart bottle, with an ounce and a half of manganese. The gas being diffused, the bottle may be stopped.

Drops required to a drachm from a *large* bottle and from a *small* bottle:—Dilute sulphuric acid, 24 and 84; prussic acid (Scheele's) 35 and 70; distilled water, 38 and 54; liquid ammonia, 40 and 48; laudanum, 84 and 135; rectified spirit, 100 and 130.

The *Eau de vie* of the French is white or coloured brandy, distilled from wine.

Enamel is made of powdered glass, oxide of lead and tin, and salt of tartar, with coloured substances.

The *Eudiometer* is founded on the principle that the oxygen in the air combines with nitrous gas, by which the bulk of the air is diminished in various degrees, so as to measure the quantity of oxygen previously combined with the azote. The Eudiometer merely detects the chemical agents in air; and, hence, confers on all air equal proportions. But the fitness of air for animal life depends on its elasticity and atomic excitement, of which the Eudiometer is no test.

To prevent mischief from *Explosion* in chemical experiments, it is usual to wrap the vessels in cloth.

Substances which chemists cannot analyze are called Extract, or the *Extractive* principle, and it appears in vegetable bodies chiefly. The red of madder, and the yellow of weld, is called Extractive.

Besides the common sillicious *Flints*, there are flints coated with oxide of iron, called iron flints.

In a fluid, all pressure exerted on one part is transferred to all other parts.

Fluoric acid is a product of Derbyshire spar and sulphuric acid. Its specific gravity is 1·06, and is very corrosive. It etches and corrodes glass, and, therefore, is kept in leaden vessels.

A candle makes a distinct flame in the *Flame* of alcohol.

Fulminating powder is 3 nitre, 2 charcoal, 1 sulphur. Preparations of gold, silver, and mercury, are fulminating.

Rose's *Fusible* metal, half bismuth, and in quarters, lead and tin, melts at 201°. At 155⅝°, it is densest, or least, and 110⅝°, most rare or largest. Above 155⅝°, it re-expands, and at 178½°, returns to its bulk at 32°.

There are three kinds of *Fermentation*, the vinous, acetous, and putrefactive, which generally succeed each other. The *vinous* fermentation arises from the saccharine principle in sugar or malt. When sugar only, yeast is necessary. At 32 deg. it stops, at 50 deg. is slow, and at 70 deg. becomes acetous. The gas disengaged is carbonic acid, carbon being carried off, and the atmospheric air not being absolutely necessary. Flavour arises from essential oils, and intoxicating properties from the alcohol. Thenard thinks that the carbon of yeast abstracts the oxygen, and then the hydrogen and carbon of the sugar combine with the hydrogen and nitrogen of the yeast. The *acetous* follows, and the presence of air is necessary; and chemists conceive that the oxygen of the air combines with the carbon of the vinous fluid. The temperature rises to 85 or 90 deg. The *putrefactive* affects all animal and vegetable substances. Air, heat, and moisture, are necessary. Vegetables give out hydrogen and carbon, and, under water, hydrogen only, and the residuum is charcoal; but, in air, the carbon becomes carbonic acid. Animal substances evolve the same and ammonia, also sulphur and phosphorus in their unpleasant odours.

Fluxes, in the large way, are lime or spar, and in the small way alkalies, as nitre and tartar.

The *Foil* of looking-glass is tin and quicksilver. Globes are foliated by the addition of lead.

Gallic acid is an astringent principle. It is formed from nut-galls, the nidus of an insect on oak-trees.

The small cavities of minerals contain expansive gases.

Extraneous *Gases* soon combine with the atmosphere. A volume of carbonic acid diffuses in a few minutes. It destroys life from the want of air.

Gastric juice is imitated by digesting mucous membranes in dilute muriatic acid.

Gin is malt spirits, flavoured with turpentine, &c. &c. combined with various substances. Geneva is made from wheat, and flavoured with juniper-berries.

Glauber's salt may be resolved analytically into sulphuric acid and soda, and may be made synthetically from sulphuric acid and soda.

Soluble *Glass* is a simple silicate of potassa, or soda, with boiling-water it forms a water-proof wash for cloths, is a cement of any required strength, and, as a varnish with clay, or ochre, it protects wood from fire.

Glue, size, and isinglass, are various forms of animal gelatine. Carpenter's glue is made of the skins of animals; and old animals make the strongest glue.

The violet rays of light tend to produce *Green* colour, by decomposing carbonic acid.

The Chinese invented *Gunpowder* soon after the Christian era, and used it in common. In 1249, an Arabic author describes its use in fireworks and shells. It seems to have been used in Europe in ordnance at the beginning of the 14th century. The Chinese use the same proportions as the English. Gunpowder expands to 472 times its bulk, with a velocity of 10,000 feet per second, and the force of 1000 atmospheres, or 15,000 lbs. per Hutton; but, per Rumford, 10 times greater. It is ascribed to the sudden rarefication of condensed air, or to the nitre, taken as 236 times that of the atmosphere.

Ten parts of tin and 100 of copper make *Gun-metal*, or brass guns.

Black *Hats* turn rusty at the sea-side, owing to the muriatic acid from the sea disturbing the gallic acid in the black dye.

Haüy's atomic theory explains, with clearness, all cases of combination, affinity, cohesion, &c. as well as the beautiful doctrine of definite proportions, which is a corollary.

Hungary water is made by distilling 2 lbs. of rosemary with 2 quarts of spirits of wine.

Hydrogen and carbonic oxide absorb half their volumes of oxygen.

Sulphuretted *Hydrogen* is highly poisonous. It escapes from lodes in some mines, and is generated by a tallow or wax candle.
Christison.

Ben oxide of *Hydrogen* is converted into water by alkalies, and also by the presence of gold, silver, manganese, platina, &c.

Hydruret of phosphorus inflames spontaneously, and fixes much oxygen.

Indigo is prepared from the leaves and small branches of an *indigo-fera tinctoria*, of which there are two varieties. It is also prepared in England from the *nerium tinctorium*, and isatis or woad. It is the blue, or sulphate of indigo, of the dyers, and a very important article.

The scales in hot *Iron* arise from the absorption of oxygen, called protoxide. Carbonate of *Iron* is a rust of iron. 100 grains of *Iron*, burnt in oxygen gas, increase to 130, with great heat and flame, proving the compound nature of the metal.

Isinglass is made of the sounds of belugas and sturgeons, which last is sometimes 18 feet long, and 700 lbs. weight.

Jade is a species of talc, and used by the Hindoos, &c. for god-making.

Lamp-black is prepared by burning resinous substances in close rooms, and collecting the smoke on woollen cloths, which are brushed; and, to expel the oil, this soot is heated to redness.

and ammoniacal gas. Sulphuric acid converts its powder into muriatic acid gas; and slaked lime its powder into ammoniacal gas. The 2 mixed reproduce the sal ammoniac.

Saliva contains saline matter and albumen, and gastric juice has the same constituents. The *chyme* in the stomach is converted into *chyle* in the small intestines, by mixture with bile and pancreatic secretion. In some animals it has been examined, and is a white fluid, with a sweetish taste, and coagulates. Its principal component is albumen, and the cerous part is like sugar of milk. In animals that feed on vegetables it is more transparent, and the coagulum is more albuminous. It is absorbed by the lacteals, and, mixed with lymph, is carried into the venous system.

The quality of *Saltpetre* is inversely as the angle of refraction, and 5 deg. is called par.—1 per cent. is allowed for every degree above.

Saltpetre is nitrate of potash.

Oil of *Sassafras*, in small quantity, renders sulphuric acid crimson.—*Hare.*

Seeds, during germination, are decomposed into carbonic acid and olefiant gas. This last then produces germination by its action on oxygen through the plumula and rootlets. The action continues while there is farinaceous matter.

Shagreen is the skin of the hound-fish, called the shagree.

Shamoy leather is the skin of the chamois goat.

Shells consist of carbonate of lime and animal gluten.

Soap is chiefly made of kelp, or the ashes of sea-weeds, dried and burnt in pits. Its refuse is used in making glass-bottles. The best soap is made of olive-oil, in the south of Europe. In England it is made of whale-oil, or tallow, and to give it a yellow colour, rosin is added. Soft-soap is made with potash, and hard with soda. Soap of ammonia is volatile liniment.

Soap is composed of oil and soda. Hard-water is impregnated with sulphate of lime. When soap, therefore, is immersed in hard-water, the sulphuric acid, or sulphate in the water unites with the soda in the soap, and the oil of the soap and the lime of the water are left floating in clouds or flakes. Hence, soap is a perfect test of sulphate of lime in water, and such water is called *hard.* In salt-water the muriatic acid combines with the soda in the soap, and produces cloudiness for the same reason.

Soda-water is made by combining eight times its bulk of carbonic acid gas, formed in the process, from chalk and dilute sulphuric acid, to which is added carbonate of soda, under pressure.

Muriate of *Soda* is table-salt.

Variety in the constituents of *Soil* is essential to fertility. It is barren when nineteen-twentieths are of one substance; hence, lime or marl improves sand or clay.

Five parts of tartaric acid and 16 of peroxide of lead, (also minium and litharge) quite dry, produce *spontaneous* combustion. Oxalic acid and citric acids, well-dried, answer in other properties, instead of the tartaric.

Spruce-beer is made of water, treacle, and the essence of spruce.

Water passed over wheat-flour carries off all the *Starch*, which falls to the bottom, and leaves the tough substance called *gluten.*

Starch is converted into sugar by boiling for 40 hours equal weights of starch and water with 1-100th of sulphuric acid, water being re-supplied for evaporation. The acid is neutralized by lime, and the sugar crystallizes. 1¼ lb. of potato-starch produces 1¼ lb. of brown-sugar.

Starch dissolved in dilute acid is converted at a certain temperature, first, into gum, and then into sugar of grapes. On abstracting the acid, only the sugar remains, rather heavier than the starch.

Sugar is clarified by boiling it at a low heat in vacuo. So the essential oils are purified at a low heat, and odour preserved.

Sugar can be made from linen rags, saw-dust, &c. by long boiling with dilute sulphuric acid, and absorbing the acid with charcoal and chalk.

The liquor of burned *Sulphur* is sulphuric acid, and, when combined with soda, it forms Glauber's salts; with magnesia, Epsom salts; and, with copper and zinc, vitriol. They are all sulph*ates* when the acid is strongest, or sulph*uric;* or sulph*ites*, when the acid is sulphur*ous*, or weak.

Sulphur, heated between two panes of glass, renders the expansion visible in transparent globules, which, of course, rise to the more distant glass, and settle on it like nebulæ. Arsenic gives crystals instead of globules.

Sulphate of soda is Glauber's salts.

Sulphate of magnesia is Epsom salts.

Sulphate of alumina is alum.

Sulphate of lime is plaster of Paris.

Sulphuret of potash is liver of sulphur.

Sulphate of iron is green copperas.

Sulphate of copper is blue copperas, or blue vitriol.

Sulphate of barytes is ponderous spar.

Sulphate of soda, or Glauber's salts, are made in Oude, from earth called *Khare Muttic*, found abundantly at Onaoo. 100 parts yield 73 of sulphate of soda, 3·5 of muriate of soda, and 12·5 of alumina.

Dilute and heated *Sulphuric* acid and alcohol produce ether.

Super-acetate of lead, is sugar of lead and litharge. Oxide of lead is Goulard's extract.

Tar is made by making a pile of pine timber, covering it with turf, and then burning it. The smoke, thus confined, descends as tar to a vessel beneath, which fills with tar, while the wood becomes charcoal. About 150,000 barrels, of 31½ gallons, are imported per annum, from Russia and Sweden.

Tartar was so called from Tartarus by Paracelsus, because, said he, it contains the water, the salt, the oil and the acid, which burn as hell does.

Tannin, the principle of the substance used in the tanning of leather, is made from nut-galls, which are likewise a constituent of writing-ink:—3 parts of nut-galls, 1 of logwood, and 1 of green vitriol, boiled in water, making the best ink.

Tannin is found in nut-galls, bark, catechu, kino, sumach, and old fustic.

A test of genuineness in *Tea* is a grain and a half of sulphate of iron. Genuine green tea gives a bluish tint; bohea, a blackish blue. Adulterated, it is all colours.

Tin-plates are made by cleaning iron-plates with acid, and then dipping them in melted tin. Tin, united with mercury, is the silvering of looking-glasses. Tin and antimony are pewter.

Turpentine is the juice of the *pinus sylvestris*. Venice turpentine of the larch. Canadian of the *pinus balsamea*. The *oil* is a distillation.

Italian *Varnish* consists in saturating the smooth surface of wood with olive-oil, and then applying a solution of gum-arabic in hot spirits of wine.

Acetic acid is distilled *Vinegar*.

Sulphuric acid is oil of *Vitriol*.

The elastic fluids which rise from *Volcanoes* are aqueous gas, carbonic acid, sulphuretted hydrogen, and, occasionally, vapour of sulphur.

Zinc and copper make brass, pinchbeck, Dutch gold, &c.

Considering that the great motions of the earth are absorbed in and by the mass; that oxygen is never found alone; that in some circumstances it produces acidity, and, in others, heat or atomic motion;—may it not, therefore, be questioned, whether it is itself other than the effect of great motions of invisible atoms, or of certain atoms of substances? Would it not, then, be the exact equivalent of Black's caloric, of Priestley's vital gas, and of Lavoisier's supporter of combustion, acidity, &c.?

The preceding question involves great principles. We know the motions of the earth (forty times greater than a cannon-ball), we know the re-action of the heterogeneous mass, and yet we have never followed those motions into systems of atoms; we know the power of certain invisible agents, and yet we have preferred to ascribe them to powers *per se*, rather than examine their connection with more obvious sources. The time, however, may come, when the ascertained connection of the earth's motions, and their necessary effect on atoms, may change the entire face of all the recondite experimental sciences!

The idea is not more bold than that of Davy and Faraday, that all chemical affinity is owing to the positive and negative electricity of the atoms of substances.

Saline draughts are 30 grains of carbonate of soda, and 20 grains of citric acid (not tartaric acid).

Butter is half, or two-thirds suet. Cream is 1-22 butter, 1-28th cheese, and 9 10ths whey.

Oils, with soda, make hard soap—with potash, soft soap.

The skin of the grape gives the colour to wines. In white wines, the husks are separated before fermentation. In red, they remain.

Champagne wines are those of Ay, Epernay, Sillery, &c. The pink is tinted with elder-berries and cream of tartar. *Burgundy* are Chambertin, Conti, Romane, &c.; white, Chablis, &c. Hermitage is made at Tain, near Lyons. *Languedoc* are Frontignac, Lunel, &c. *Bordelais*, or *Clarets*, are Medoc (of several kinds), Grave, Palus, &c.; the white are Barsac, Sauterne, &c. Spanish wines are Sherry, Malaga, and Tinterella. *Italian* are Muscadel, Lachryma Christi, Marsala, &c. *German* are Tokay, Hochkeim, Berger, Schoss, Johannis, &c.

It is doubted whether rock-salt is of marine origin, because it contains none of the compounds found in sea-salt, and no fossil remains. Some salt-rocks, too, are 120 feet thick in insulated mountains, as at Cardona, and near Cracow. The Droitwich springs proceed from a river 2 feet deep, which runs over rock-salt 250 feet beneath the surface, and 1-4th of the brine is salt. Other brines are but a ninth.

Metals oxydate, but do not ignite in atmospheric air. The air requires an extra dose of oxygen before they become incandescent. The heat of the fixed oxygen is then sufficient to excite their proper hydrogen. Their carbon gives peculiar colour to the flames.

Soda-water contains 8 times its own bulk of carbonic acid gas, and some soda. Forcing-pumps omit the soda.

Potatoes, in the boilers of steam-engines, prevent the cohesion of carbonate or selenite of lime.

HEAT.

There can be no reasonable doubt that Heat is a mere effect of atomic motion, and that various intensities by percussions, or motions applied, transferred to various atoms and to various combinations, is the cause of all the phenomena of heat.

The sources of Heat, or atomic motion, are the great motions of the Earth, acting on its own parts; and the solar heat acting on the surface, so as to convert fluids into gas, and assist the evolution of germs.

The three states of matter are immediately connected with degrees of Heat. 1. The *solid* state supposes no heat, or only such a degree as excites atoms in the pores, and coincides with the general internal heat. 2. The *fluid* state is an effect of great excitement, by which the atoms in the pores break up crystalline structures, and produce the middle state of fluidity. 3. The fluid state would, however, become at once *gaseous*, but for the elasticity of previously-created gas, which obstructs the radiation of the fluid atoms, till acted upon by artificial heat up to 212°, or naturally by the re-iteration of solar heat. The fluid atoms, in rising into space, are so re-acted upon by the gas in the

space, that they are turned into circular orbits, extending great motion through the atmosphere, which motion, absorbed and refixed in respiration, &c. is the source of all organic life and power.

The knowledge of heat, its causes and accidents, is essential to the study of chemistry or the science of atoms, for we have no access to atoms except by *heat* in some of its forms. The leverage of sharp tools is not fine enough: but in moving atoms by heat, or heating them by motion, for the terms are equivalent, we disturb their relations, separate or decompose them, and thus are enabled to form new combinations.

The fundamental principles of all physical philosophy are correct conceptions of the construction of gas, of *heat*, and of the motions which produce the relative affections of bodies, neither of which is embraced by the scholastic philosophy.

Cold is the mere absence of the motion of the atoms called heat, or the abstraction of it by the evaporation of atoms, so as to convey away the motion, or by the juxtaposition of bodies susceptible of motion. Cold and heat are mere relations of fixity and motion in the atoms of bodies.

Heat is repulsive, because it is the motion of atoms, and opposed to their rest or cohesion. Their motion demands space, and hence expansion. Heat is found in all bodies whose atoms can be moved, or excited by percussion or friction. It is simply motion applied to any atoms, directly, or by transfer.

Black advanced an odd hypothesis, that heat was a *property* of certain atoms called caloric, which moved from one body to another; and, when not in motion, was *latent* in the bodies.

The immediate cause of the phenomena of heat is motion, and its laws are *precisely the same as those of the communication of motion.—Davy.*

The demands for motion or heat from surrounding bodies during all *expansions;* and its radiations, during *condensations*, are illustrations of the principle.

Expansion, universally, is evidence of the accession of heat in the expanded body, and of its departure from other bodies. On the contrary, contraction is evidence of the departure of heat from a body, and its acquisition by other proximate bodies.

The diminution of specific gravity by the expansion of heat, and the contrary, prove that heat is merely an affection of the existing atoms of the substance.

No heat is ever created. It is always a transfer of the motions of gases as in fires, and of the motions of gases in the interstices of other bodies.

No heat is ever lost. In all cases it is only a transfer. In winter, more is transferred than received, and in summer more received than parted with. If one hemisphere is cold, the other is so much hotter.

Blacksmiths commonly light their matches by giving a nail five or six quick strokes with a hammer. Most savage nations produce fire by rubbing two dry sticks together.

Pieces of ice rubbed together melt; pieces of brass rubbed together in an air-pump, become hot; and a vacuum transmits heat, owing to the radiation of the atoms of the substance which forms it.

Count Rumford, by boring a cannon within water, so heated it by the friction that he made it boil, and actually boiled a piece of beef in it. The temperature of nine quarts was raised from 60 to 170 degrees in an hour, and in two hours and a half the water boiled, the whole heat being equal to what would have been produced by nine wax-candles burning the same time.

In strong percussions, the first blow produces the greatest heat, and the greatest change in density; thus, in coining copper of 8·85, the first stroke renders it 8·89, with an increase of heat of 10 deg.; but the second stroke makes it only 8·91, with 4 deg.

The coarse mechanical methods of exciting heat are called percussion and friction; thus, a hammer struck on metal, or any hard body, makes it hot; but if struck on a friable non-cohering body, which yields to the velocity and disperses by the blow, no heat is produced.

The heat produced by friction is well-known to all mechanics, and is diminished either by making the surfaces smooth with unctuous substances or by water, which evaporating carries off the excitement.

Gas, or aqueous vapour, may be formed by striking a piece of iron some quick blows with a hammer. The momentum of the hammer is thus transferred to the atoms of iron, which, by reaction from their sub-parts, radiate invisibly, and the iron affords as a result the sensation of heat, which continues till the momentum imparted is radiated. If some water, which radiates *visibly*, is put on the iron, the water is dispersed in steam or separated atoms. These emerge into a space filled with aerial atoms, and suffer constant deflections in every direction, which ultimately produce small circular orbits of each atom in intense velocity. The aggregate then produces a cloud of steam, which continues till the motions have been parted with, when it is precipitated as water. The motions of the hammer are, therefore, *in* the steam.

All other gas is virtually or actually made in the same way, and the size of the orbits depends on the excitement, and on the bulk and form of the atoms affected.

Some misapplications of mathematics have been made by the French analysts, based on the false theory that heat is, as heat, a fluid, and not the mere motions of atoms which indicate heat in the atoms of other bodies when it has been imparted to them. La Place, Fourier, and Poisson, have distinguished themselves in these enquiries. They infer, 1. That the range of the oscillations becomes less as we recede from their origin. 2. That oscillations for the longest of two periods, are sensible to the furthest distance. 3. That the diminu-

tion of the range is less rapid as the conducting power increases. 4. That the maximum dispersion is, at successive times, at different distances. All very trite.

The motion of heat does not pass through bodies till it has put their atoms in uniform motion. Some bodies are more susceptible, or contain more susceptible atoms than others. Silver and gold, copper and tin, are among bodies the most susceptible of atomic excitement, and *conduct* heat the best; other metals have less facility, stones less than metals; brick, glass, dried woods, and charcoal less still; feathers, silk, wool, and hair, least of all bodies.

Conducting-power is an effect of the continuity of the matter, and is less as the interstices between the atoms are greater. Liquids are vapourized by heat, and, therefore, are bad conductors. Gases are enlarged by it; and, therefore, it is exhausted within themselves.

When heat, or atomic motion, is not sensible to the thermometer, it is because the atoms of the body are better fitted to receive and exhaust the action than the fluid in the thermometer. In the experiment of melting ice in heated mercury, the susceptibility of the ice to become water, and the conversion absorbs all the motion till the liquifaction is perfect, and it has nothing to do with the nonsense about latent heat, free heat, or matter of heat.

Heat-making rays are subject to the laws and accidents of light, but they pass only through short distances; while light protrudes the atoms of space to infinite distances.

Heat is less refrangible than light; that is, its waves are of greater length.

That fluidity and gasification are caused by motion, is evident from the effects of antagonist elements, which, as solids, have no action, but only as fluids or gases.

The heat which accompanies voltaic and electrical restoration, is a proof that heat is mere motion.

As water, in heating, does not completely overcome atmospheric pressure till 212°, and the radiation is then in gas, or circular orbits, or 6·2832 times the previous direct radiation, so 212 by 6·2832 determines the beginning of the direct action, which, by re-action, ends in a circular orbit. Then $\frac{212}{6\cdot2832} =$ 33° 74'. Hence, it would appear, that, at 33° 74', radiation commences, and goes on till at 212°, when it is sufficient to produce gas with the requisite velocity of 6·2832. There is no acceleration, because each radiated atom stands alone. It would thus appear that atmospheric pressure overcomes radiation, till the radiated atoms have a velocity equal to the perfection of a circle, and then it is aqueous gas. The speculation is at least curious.—*Phillips.*

Animal heat and animal energy are immediate sequences of the respiration of aerial gas. Thus, a man consumes 33 cubic inches of air in his 20 ordinary respirations per minute; and the 28 cubic inches of its oxygen becomes carbonic acid gas, whose specific heat is reduced as 1 to 0·286. This is 1728 inches in 61 minutes, containing 876° of absolute heat, and an absorption of 876 — 195 = 691° of absolute heat, or motion, is therefore fixed in the system, in about an hour. In exertions, it is doubled or trebled in quantity.—*Ibid.*

Combustion.

Combustion is the destruction of a body by the union of its hydrogen with oxygen, and the simultaneous dispersion of its carbon in smoke and flame. The three elements are necessary, and always present. The heat arises from the fixation of the oxygen gas, or its condensation from its gaseous to a condensed fluid or solid form.

We create a flame, or light a candle, by exciting its hydrogen by another flame. Oxygen in the air then combines with heat, this excites more hydrogen, and the flame continues as long as hydrogen and oxygen are present.

In combustion, 1 lb. of *hydrogen* consumes 6 lbs. of *oxygen;* 1 lb. of carburetted hydrogen 4 lbs. of oxygen; 1 lb. of olifiant gas, of olive-oil, of wax, and of tallow 3·5 lbs. of oxygen; 1 lb. of phosphorus 1·5; of charcoal 2·8; and of sulphur 1·36 of oxygen.

One lb. of hydrogen and 6 of oxygen melt about 350 lbs. of ice; 1 lb. of rape-oil and 3·5 of oxygen, 124 of ice; 1 lb. of carburetted hydrogen and 4 of oxygen, 85 of ice; 1 of charcoal and 2·8 of oxygen, 50 of ice; and 1 lb. of caoutchouc, 42 lbs. of ice.

Steam at 212° condensed to ice, gives out 950° heat to an equal quantity of water.

A pound of	Coal melts	90 pounds of ice.
	Coke	94
	Wood....	52
	Charcoal	95
	Peat	19

Oxygen is called the *supporter* of combustion; and other bodies are so called, owing to the atoms which they contain being fixed in like manner by hydrogen. The products of this union, or combustion, are water, carbonic acid, and vapour.

When metals are consumed, the calx, or oxyde, is heavier than the metal, by the quantity of oxygen, which has been fixed and combined. The hydrogen evolved by the first, and the continued excitement, is called the *inflammable gas;* and no combustion takes place without it, in greater or less proportion. Bodies which do not contain it, as stones, bricks, &c. are incombustible. Flame, fire, &c. are, therefore, mere effects of the union of two gases, one of which fixes the other, and subdivides and explodes the carbon.

All bodies contain hydrogen, which become incandescent, or which create an oxide during heating and melting.

Prometheus brought fire from Baku, or other burning exhalations, in the dry marrow or pith of the ferula or northica to Greece. Poets made the Fable, and Priest-craft consecrated both it and fire. They little imagined that fire is the mere fixation of the oxygen of the atmosphere by union

with excited hydrogen and carbon, which all inflammable substances evolve.

Newton considered flame as *red-hot smoke;* but modern science regards it as the place where oxygen unites with hydrogen and carbon, and the diminution of volume transfers an atomic excitement to the carbon, which protrudes as light.

Combustible bodies will not burn if dipped in a solution of potash, or phosphate of lime, or muriate, sulphate, or phosphate of ammonia, with borax. Alkaline substances arrest the hydrogen, or prevent its combination with oxygen.

Argand's lamp carries a current of air through the wick, by which more oxygen is fixed; so with bellows.

Keiby's *gas burner*, of very small holes in a circle, (the ascending air preserving an upright cylinder) gives equal light, with 30 per cent. less gas.

Solids become incandescent in the dark, at 600° or 700°, but not in day-light till 800° or 1000°.

Iron-works save two-thirds of their coals by using heated air for *blasting*, instead of cold air. Heat is the fixation of *excited* oxygen, and the excitement is accelerated.

The vapour of tar ignites at 200°.

Lamps were used by the ancients, and candles were an invention of the middle ages. At first, wicks were made of hemp, papyrus, and the pith of rushes.

The safety-lamp is founded on the principle that flame, in passing through iron-wire meshes, loses so much of its heat, as not to be capable of igniting inflammable substances around, (flame alone igniting gas.) There ought to be above 625 apertures to the square inch. A pin stuck in a rush-light extinguishes it on the same principle of conveying heat from the wick.

A pint of good oil burns above eleven hours in an Argand lamp, with a light three to one greater than a six mould-candle; but a pint of the *purified* colza oil, burnt in Paris, lasts thirteen hours, and gives light four to one greater than a six mould, and perfectly white.

A lamp with eight threads of cotton burns 0·325 oz. of oil in an hour; one with four threads 0·1664 oz.

The heating power of combustibles is nearly in the ratio of their carbon. Much British coal contains from 90 to 95 per cent. of carbon.

A gas-light equal to one good candle consumes 1·43 of cubic feet of gas per hour; to four candles 1·96 per hour; six candles 2·4; eight candles 2·95; and to ten candles 3 cubic feet.

In flint and steel, the intense excitement of the steel occasions the parts to take fire.

MOLLET'S CONDENSER consists of a cylinder and solid piston; closely fitted, and the cylinder containing air, the piston is forced into it, so as to drive the air into less space. Then, as the quantity of motion which sustained the first bulk of the air, is less in less bulk, it is parted with to the cylinder, which becomes intensely hot. But, if an orifice is opened at the side by a small cock, the heated air rushes out, and sets fire to a piece of tinder, or to the smoke of a candle just extinguished. It is a beautiful exemplification of the theory of gaseous construction.

Deal wood, injected with alumine, is partly incombustible.

Intensity of Heat.

Relative intensity of heat is shewn by the thermometer, an instrument consisting of mercury, or spirits, in the bulb of a tube. As the heat, or atomic motion, increases, the mercury, or spirits, in the bulb swells and raises the connected thread of the fluids in the tube. The heighth, then, at which water freezes, is called by *Fahrenheit* 32°, and at which it boils 212°; and the intermediate 180°, parts down to 0°, or Zero, are marked as a scale. The *Centigrade* begins with 0° at the freezing point, and divides up to 212° of Fahrenheit into 100 parts. *Reaumur's* is another division into 80 parts, in which 24° of Reaumur are equal to 30 Centigrade, and to 86 of Fahrenheit; and 20 of *Reaumur* are equal to 25 *Centigrade*, and 77 of *Fahrenheit*.

The Thermometers of Fahrenheit and Centigrade.

Fahr.	Centigr.	Fah.	Centi.	Fah.	Centi.
—4°	—20°00	33°	0°56	70°	21°11
—3	—19,44	34	1,11	71	21,67
—2	—18,89	35	1,67	72	22,22
—1	—18,33	36	2,22	73	22,78
*Zer.*0	—17,78	37	2,78	74	23,33
1	—17,22	38	3,33	75	23,89
2	—16,67	39	3,89	76	24,44
3	—16,11	40	4,44	77	25,00
4	—15,56	41	5,00	78	25,56
5	—15,00	42	5,56	79	26,11
6	—14,44	43	6,11	80	26,67
7	—13,89	44	6,67	81	27,22
8	—13,33	45	7,22	82	27,78
9	—12,78	46	7,78	83	28,33
10	—12,22	47	8,33	84	28,89
11	—11,67	48	8,89	85	29,44
12	—11,11	49	9,44	86	30,00
13	—10,56	50	10,00	87	30,56
14	—10,00	51	10,56	88	31,11
15	— 9,44	52	11,11	89	31,67
16	— 8,89	53	11,67	90	32,22
17	— 8,33	54	12,22	91	32,78
18	— 7,78	55	12,78	92	33,33
19	— 7,22	56	13,33	93	33,89
20	— 6,67	57	13,89	94	34,44
21	— 6,11	58	14,44	95	35,00
22	— 5,56	59	15,00	96	35,56
23	— 5,00	60	15,56	97	36,11
24	— 4,44	61	16,11	98	36,67
25	— 3,89	62	16,67	99	37,22
26	— 3,33	63	17,22	100	37,78
27	— 2,78	64	17,78	101	38,33
28	— 2,22	65	18,33	102	38,89
29	— 1,67	66	18,89	103	39,44
30	— 1,11	67	19,44	104	40,00
31	— 0,56	68	20,00	105	40,56
F.P32	— 0,00	69	20,56	106	41,11

The *Centigrade* thermometer divides the

180° of *Fahrenheit*, *i. e.* from 32° to 212°, into 100 degrees; and *Reaumur* divides the same space into 80°. Hence, the 32° of *Fahrenheit* is the 0 of *Reaumur* and the *Centigrade*.

The thermomultiplier measures heat the 1500th of a degree of Fahrenheit.

The mean temperature of man is 98° 6′; of mammifera, in general, 98 to 104°; of dogs, 103°; of cats, 163° 5′; of birds, about 104°, but pigeons are 107°; fishes are from 50° to 64° Fah.

Water boils, bar. 30 inches, at 212 Fahr., 80 Reaumur, and 100 Centigrade. Tallow melts 127 Fahr. Fever heat, 112 Fahr.; blood-heat 98° Fahr. Temperature of spring-water 50°. Water freezes 32° Fahr.; 0 Centigrade, 0 Reaumur. 0 Fah., is 14¼ Reaumur below Zero, and 18 Centigrade below Zero, or—14°·5, and—18°.

Ether boils at	104 degs.
Alcohol	173·5
Nitric acid	210
Oil of turpentine	304
Sulphuric acid—1·8	472
Phosphorus	554
Sulphur	570
Linseed-oil	640
Mercury	656

That is, they cannot be made hotter, and their steam, which equalizes their heat, then balances the atmospheric pressure at 30 inches.

Wedgwood's Pyrometers consist of small cylinders of porcelain clay, which permanently contract at great heats, but uncertainly. His scale commences at 1077° of Fahrenheit.

Eggs are hatched at 104° of heat.

Guyton Morveau makes mercury boil at two degrees of Wedgwood, or 642·75 of Fahrenheit. Silver melts at 22 W., 1822·67 F. Gold 32 W., and 2517·63 F. Cast-iron 130 W., and 8696·24 F. Nickel, platina, and malleable iron 175 W., and 11454·56 F. He makes Wedgwood commence at 517 F., instead of the usual 1077·5. Daniel makes the boiling point of mercury 644.

Polished steel is a blue colour at 580°, and straw colour at 460°.

Daniell makes brass *melt* at 1869; silver 2233; copper 2548; gold 2590; and cast-iron 3479, which last Wedgwood made 20577.

A platinum pyrometer gives different results; by it

Silver *melts*	1823 Fah.
Gold	2518
Cast-iron	8696

By the platina scale, mercury boils at 643; zinc melts 705; copper 2205; platina 11454.

Daniell makes the heat in a common parlour-fire 1141°.

The best heat of family sitting-rooms is 70°, and of sleeping-rooms from 50° to 60°.

The metals which retain heat the longest are brass and copper, then iron and tin, and lastly lead.

As heat rises with the rarefied air, Count Rumford taught to place grates low, to make chimnies small, and mantle-pieces low.

Pressure by the hand on gas, in a glass piston, will raise it 400°, the heat which sets fire to various bodies.

Man, and warm-blooded animals, under the influence of excessive heat in dry air, cannot, during life, sustain an elevation of vital temperature beyond 12° or 13°. In cold-blooded animals, 105° is the greatest degree of heat which these could bear.

Sea-water is seldom below 40°; springs about 45°; and pools and small rivers are as the atmosphere.

The mean heat of the human body is 98°, and of the skin 90°. A slight breeze at 70°, cools at 80° in 3 minutes, a pair of bellows in 1 minute, water in 24 seconds, agitated water in 15 seconds, and lamp-cotton in 3 minutes.

Artificial hot-baths are generally 6° or 7° higher. The king's bath, at Bath, is 116°; the hot-bath 117°; at Vichy 120°; at Barege 122°; Borset 132°; Aix la-Chapelle 140°; Carsbad 165°; Baden and Pisey 104°; Buxton 82°; Bristol 74°; Matlock 66°.

A bath at 150° scalds, but air heated to 260° is not painful.

The lowest heat for fermentation is 57·5; the highest 77°.

The lowest, for drying herbs, &c. 77°, and the highest 122°.

The greatest which the feet will bear in water 100°·5.

The usual heat at which tea and coffee are drank 110°.

Water simmers at 178°. Pure water boils at 212°; but, with one-fifth salt, not till 218·75; and as syrup, not till 221.

Water, which boils at 21° at the foot of Mont Blanc, boils at 187° at the top; while the barometer at bottom was 30·534, and at top 17·136. Then the elevation being 15,000 feet in 25° of Fahr., every 600 feet of elevation lowers the boiling point 1° of heat.

In a vacuum, all liquids boil at 124° less than in the open air. Hence, water boils at 88°, alcohol at 49°, and ether, which boils at 96°, is already vapour.

If, by means of the air-pump, the pressure of air be reduced to one-half, water will boil at nearly 180°.

The same heat which raises water 1° raises oil 2°, owing to the evaporation of the water. The heat required to raise water, oil, and mercury 1° is 28, 14, and 1.

Hemp, cotton, matting, &c. with oil and lamp-black, generate heat, and finally ignite spontaneously, when exposed to air.

Every effect of the most violent heat of furnaces may also be produced by the flame of a candle or lamp, urged upon a small particle of any substance, by the common blow-pipe. This instrument consists merely of a brass pipe, about one-eighth of an inch diameter at one end, and the other tapering to a much less size, bent, and having a very small perforation for the breath to escape.

In the oxy-hydrogen blow-pipe, 2 volumes of hydrogen to 1 of pure oxygen produce the greatest heat and light ever produced. Every hard and untractable substance is fused, melted, and dispersed immediately.

Rock crystal and quartz are converted into glass. Opal and flint into enamel. Blue sapphire, talc, emerald, lapis lazuli, are converted into glass. Gold and diamond are volatilized. Platina and brass wire burn with a green flame. Copper melts without burning; but iron burns with brilliant light. Iceland spar and strontian, and pure lime, give out an amethyst flame.—*See* OPTICS.

When oxygen and hydrogen are burnt, the heat is 2578°; but the same oxygen and charcoal give 2967°; and with iron, zinc, and tin, 5825°.—*Despretz.*

Tallow melts at 92°, spermaceti at 133°, and bleached wax at 155°

Expansion and Contraction.

Solids slightly dilate by enlarging the orbits of the gases in their pores. Further enlargement, by more heat, breaks up their structure, and ultimately renders the whole fluid as a volume of excited atoms. The degree of excitement, to effect this, varies with the structure. Mercury, alcohol, ether, &c. have feeble structures; and platinum, gold, iron, &c. impregnable structures.

Daniell has recently determined the expansion of the following bodies, from 1 in length at 62°, to be at 212° and at 662°:—

	212°	662°
Black lead............	1·000244—	1·000703
Platinum	1·000735—	1·002995
Wrought iron	1·000984—	1·004483
Cast ditto	1·000893—	1·003943
Gold	1·001025—	1·004238
Copper	1·001432—	1·006347
Silver	1·001626—	1·006886
Zinc	1·002483—	1·008527
Lead	1·002323	
Tin	1·001472	

The linear dilatations of bodies, from 32° to 212°, is as under, by La Place, &c.

Silver	0·0019097	$= \frac{1}{523}$
Copper	0·0017173	$= \frac{1}{582}$
Cornish Tin	0·0021730	$= \frac{1}{462}$
Forged Iron	0·0012205	$= \frac{1}{819}$
Flint-glass	0·0008117	$= \frac{1}{1248}$
Gold	0·0014661	$= \frac{1}{682}$
Platinum	0·0008565	$= \frac{1}{1167}$
Lead	0·0028484	$= \frac{1}{356}$
Glass of St. Gobain ..	0·0008909	$= \frac{1}{1122}$
Mercury, in volume, ..	0·018018	$= \frac{100}{5550}$
Water	0·0433	$= \frac{1}{23}$
Alcohol	0·11	$= \frac{1}{9}$
All the Gases	0·375	$= \frac{100}{287}$

Roy determined the expansion of brass from 32° to 212° on a foot, to be ·0227 of an inch; on steel to be ·0137; on cast-iron ·0133; and on a glass rod ·0097.

Roy made a glass-tube, in 10 millionths of an inch, which, on a foot length, expanded 46,569; a glass rod 96,944; cast-iron 133,126; steel-rod 137,368; brass rod 227,136.

Granite, at dull-red heat, expands a 0·02 or 0·0166. At full red heat it decomposes, and at a white-heat vitrifies. Porphyritic felspar expands 0·019 and 0·018. Clay-slate 0·0158 and 0·0135. Green-stone 0·0125. Serpentine no expansion.

Steel and zinc expand as 2 to 5, and they are used by Ure as a Thermostat.

Lead expands but a 350th between 32° and 212°; iron but the 800th, and glass the 1000th in round numbers; but the expansion is in the three dimensions, and three for the whole times that of either. Heating and cooling, at the same degrees, give the same results.

1000 inches of air, or any gas, raised from 32° to 212°, expands to 1375 inches uniformly through the 180°—so that, $\frac{375}{180}$ = 2·0833 inches, is the increase per 1000 inches for every degree, with invariable exactness in all.

Mercury dilates more rapidly, as it rises towards its own boiling point. Other metals and bodies also vary their rate of expansion.

Taking air at 32° as 1, then, at 33 below Zero, it is 0·865; at 212° above it is 1·375: at 392°, 1·7389; at 572°, 2·0976; and at 680°, when mercury boils, air is 2·3125. Hydrogen, and all the gases, expand in the same proportion, *i. e.* 1-480th to a degree of heat. Downwards they decrease a 480th for every degree of abstraction of heat.

At 512°, they are double in bulk, and, at 448° below Zero, are half their bulk at 32°.

At 60° the bulk is 28-480ths larger than at 32° or 508, and the density the 508th, instead of the 480th.

The decimal of $\frac{1}{480}$ is 0·00208, which is the constant multiplier for any difference of degrees. Thus, at 60°, or 28° above 32°, the expansion is as 0·00208 × 28, or 0·05724, and any bulk at 32°, increased by this 0·05724, its quantity is the bulk at 60°. If 100 cubic inches, at 32°, it is 105·724 at 60°; and if 100, at 60°, it is the 0·05724 less at 32°.

The increase of 2·0833 in every 1000 cubic inches, is the 480th of the bulks for every degree, and no doubt it must arise from the enlargement of the orbits of the atoms which constitute the activity and form of the gaseous state; 480 inches thus become 481 for every degree of heat or motion.

The intense motions which exist in atoms, when gaseous, is proved by their re-condensation. In this way, the condensation of muriatic acid gas has transferred its own motions, so as to make mercury boil at 656°.

Liquids expand, by heat, in various increasing ratios. The greatest density of water is 39·39.

Mercury expands between 32° and 212° 0·02 to 0·018. Water 0·0433. Fixed oils 0·08. Alcohol 0·11.

100 parts of air at 32° expand at 40° to 101⅜; at 50°, to 103¾; at 60°, to 105·8; at 70°, to 108; at 80°, to 110; at 100°, to 114; at 120°, to 118; at 150°, to 124⅛; at 200°, to 135; and at 212°, to 137·4.

The seconds' pendulum, of 39·139 inches,

is lengthened by 30° of temperature 128th of an inch, or 8 vibrations in 24 hours.

Liquids vary much in their rate of expansion when the temperature approaches their boiling, or solidifying points.

The maximum density of water is about 7 or 8 degrees above the freezing point. Some fix it at 39°, others at about 40°, and for 2 or 3° it is about the same. Below this point water sinks to the bottom.

The force of dilatation in solids is equal to that with which they resist compression; and that of contraction is equal to the resistance to extension.

The force of dilatation in liquids is equal to the great force with which they resist compression.

Beaumé's hydrometer floats in distilled water for heavy fluids, or, for light fluids, in water with 1 oz. of dry salt. The temp. is supposed from 56 to 60, and the sp. gr. of water 1, and brine 1·075. The scale for heavy fluids runs from 1 to 75, or from sp. gr. 1·007 to 2·087. 13 gives sp. gr. 1·1; 26 is 1·2; 48 is 1·5; and 64 is 1·8. For light fluids, the range is from 59 to 10; 50 shewing sp. gr. 0·782; 46 being 0·8, and 26 being 0·9. It makes the lightest fluid, the hydrocyanic acid, 0·7; and the heaviest, sulp. acid, 1·85. At 1·1 the wort of strong ale exactly floats a new-laid egg.

Babbage maintains that solid rocks expand by heat, and that clay only contracts. Also, that different strata conduct heat differently, and that the surface radiates differently.

Heat, or atomic motion, added to water above 212°, carries it off in gas or steam; but, by compression in strong vessels, Perkins has made water red-hot.

Wheels and casks, bound by hoops, swell by heat, and the contraction renders them more binding.

When a bulk of lime and water are combined, the heat is caused by a condensation equal to the bulk of lime, for the mixture is the same bulk as at first.

Acids combining with water condense it, and produce heat.

The compression of water, by thirty atmospheres, gives out the sixty-sixth of a degree of heat.

Conducting Powers of Bodies.

Taking the heat-conducting power of water at 10, ash has 91, elm 32, oak 33, and fir 39. The densest *woods* are the best conductors of heat. Hornbeam (4 inches 10 lines long and 1 inch thick) conducts 54°; oak 50·5, chesnut 53·7, fir 47·91, poplar 47·59, and cork only 17·5.

The relative conducting powers of heat, through the following bodies in seconds, are air 576, lint 1032, wool 1118, raw silk 1284, beaver's fur 1296, eider-down 1305, and hare's fur 1315. Hare's fur, eider-down, caoutchouc, wool, and silk, are the worst conductors.

Cork and wood from boiling water may be handled, but not metals, though both affect the thermometer equally.

The heat-conducting powers of metals, &c. are

Gold	1000°
Platinum	981
Silver	973
Copper	898·2
Iron	374·3
Zinc	363
Tin	303·9
Lead	179·6
Marble	23·6
Porcelain	12·2
Fine clay	11·4

To economize heat, Forbes used very thin plates of mica, since glass, like alum, transmits little heat. He found, too, that his thin mica-plate interposed between crystals, and turned 45°, augments both the refracted light and heat.

Rock salt transmits the whole of all heat, making rays.—*Melloni.*

Radiation of Heat.

All hot bodies distribute their heat, or atomic motion, to other atoms around, and this depends on the roughness of the surface, as exposing the greatest number of points to surrounding atoms. Metals radiate the least, and lamp-black, paper, and glass, the most.

A thermometer fell from 190 to 68°, in a vacuum, in 10 minutes; but, in air, in 6 minutes. Two tin globes, one painted lamp-black and the other bright, the first lost half its heat in 35 minutes, and the other in 44 minutes.

If the surface of the metals is scratched or roughed, the radiation, of course, is increased, because the excited atoms which cause the heat have more points for distribution to the atoms around.

Lamp-black vessels radiate motion as 100, glass as 90, tarnished lead 45, bright lead 19, and tin, gold, silver, and copper, as 12. It is more rapid in a vacuum. The absorbing power is directly as the radiating, and the conducting and reflecting power is the reverse.

The visible radiations from heated bodies are reflected like light, but they do not pass through transparent bodies.

A naked body, in air, cools in 576 seconds, in wool in 1118 seconds, in cotton in 1046 seconds, in hare's fur 1315 seconds, in raw silk 1284 seconds, and in eider down 1305 seconds.

The heat-making atoms which evolve from an iron stove at a black heat, are visible in a sun-beam in a dark room.

A thermometer, at a certain elevation, was cooled in air (azote and oxygen) in 100 seconds, in hydrogen in 40, in coal-gas in 70, and in carbonic acid in 112 seconds.

Heat is emitted from every point of a hot body in all directions, and the intensity of the moving atoms, from any surface, is as the sine of the angle which the radiating atom makes with the surface.

The radiation and reflection of heat and cold was known in Italy in the 17th century.

A radiating surface, covered with black Japan varnish, has twelve times more power

than a metallic surface. If a canister, varnished and metallic, be heated, a thermometer of ether and dragon's-blood rises to the varnished side as 12 to 1 on the metallic side. But, if the canister is cooled, the varnished side lowers the thermometer as 12 to 1 on the metallic.

Heat, at a certain distance, equal to 9½° is 6½ passed through rock salt, 1⅛° through rock crystal, and 1° through alum.

Dulong and Petit have established that the quickness of cooling is not constant, but in geometrical progression, while the surrounding space is in arithmetical progression.

Experiments of Melloni lead to the belief that hot bodies radiate two kinds of atoms.

Specific Heat.

The specific heat, or inherent mobility, has been determined for every kind of body. WATER is taken as 1; then HYDROGEN GAS is 21 by Crawford, and 9·4 by Dalton; OXYGEN at 4·7 by Crawford, and 1·3 by Dalton; AIR 1·8; AZOTE 0·8 by Crawford, and 1·8 by Dalton; aqueous STEAM 1·55 by Crawford, and 1·17 by Dalton; ALCOHOL, by several averages, 0·8; LINSEED and WHALE-OIL 0·5; arterial blood 1·03, and venous blood 0·89; farinaceous substances 0·5 and 0·4; pit-coal 0·28; cinders 0·19; glass 1·9; iron 0·12; silver 0·08; gold and lead 0·05.

The varied susceptibility is proved by mixing the same quantity of fluids at the same temperature; thus, if oil at 50 be mixed with water at 100, the result in heat is 83⅓, and not the mean 75°.

If oil, at 100, is mixed with water at 50, the result is 66⅔.

Though lead melts at 594 by itself, bismuth at 460, and tin at 408 degrees of Fah.; yet, if mixed in the proportions of 5, 8 and 3, they melt at 200°.

Water, in passing to vapour, expands 1696 times, alcohol 659 times, ether 443 times.

One lb. of mercury at 185°, and one lb. of water at 40°, give a temperature of 45°, but reversed it is 180°.

Three parts of snow and four of potash, or two parts of snow and three of crystallized muriate of lime, produce 83° of cold.

Two parts of common salt, mixed with two of ice or snow, produce a degree of cold five degrees below the Zero of Fahrenheit. One of sal ammoniac, and two of common salt, with five of snow, make it seven degrees colder. And equal parts of nitrate of ammonia and common salt, with two and a half of snow, reduce it 25 deg. below Zero. Five parts of muriate of lime and four parts of snow freeze mercury. If the muriate of lime be crystallized, or four parts of dry caustic potash be added to three of snow, 50 deg. below Zero may be acquired.

Walker, of Oxford, produced 91 deg. below Zero, by applying two parts of sulphuric acid to snow.

Salts, in water, lower the freezing point. Thus, 25 per cent. of common salt, in water, lowers its freezing point from 32 deg. to 4 deg. but other salts less. Hence, water frozen at 32 deg. is liquified by 25 per cent. salt, till the thermometer falls to 4 deg. and in proportion for other quantities of salt.

Acids and salts absorb moisture, and as they and the water freeze at different degrees, freezing decomposes them, while the temperature in connection occasions the water not to freeze at 32 deg. Sea-water, therefore, does not freeze so soon as fresh-water. 25 per cent. of sulphuric and nitric acid lowers the freezing point of the mixture to 7·5 and 7.

When snow or pounded ice are mixed with salt, or the acids, these dissolve the solid crystals into fluids, and in converting solidity into fluidity withdraw motion from surrounding bodies, so as to be capable of producing a cold of 70 deg. below Zero.

Solid carbonic acid sinks the spirit thermometer to 162 Fah. below Zero, in two minutes. 180 grains of mercury, poured into a concavity of it, are solidified in a few seconds.

Water, saturated with nitre, loses 17 deg. of heat, and with nitrate of ammonia 46 deg. of heat.

The varied heat of saline bodies in water depends on their fixed water of crystallization, which in becoming liquid absorbs the heat. 300 grains of carbonate of soda contain 137·5 of water of crystallization, and the solution lowers temp. from 16° to 20°.

As much atomic motion is imbibed by a pound of ice in melting, as would raise a pound of water to 135 degrees. Black made it 140 degrees, which, multiplied by ten, as the whole heat in water, at 32°, gives 1400° as positive *zero*, when no heat would remain in water. Crawford made it 1532°; Gadolin made it 1432°; and La Place 3460°; while Desormes makes it only 448°.

Apjohn determines the specific heats, per equal volume (air being 1) of nitrogen, 0·9613; of hydrogen, 0·1315; and of carbonic acid gas, 1·6677.

Water requires the same heat to be continued the time into 32, to raise it from 50° to 60° that mercury requires, owing to its facility of evaporation. This is ambiguously called specific heat; but it merely expresses the facility of being excited. Mercury, in this case, is said to have a specific heat of a 32d that of water. So iron is 110, silver 80, and tin 70.

Freezing and Crystallization.

Solids, which are capable of becoming fluid, are those only which form crystals when returning to the solid state. They often unite much of the water, called the water of crystallization. Metals, or glass, rendered fluid by heat, crystallize on cooling. Flat glass, or porcelain vessels, are best, and to grow the crystals must be turned, and the solution renewed. Some are formed by the cooling of the solution; others by evaporation, in one case by abating the intestine motion or fluidity—in the other by diminishing the volume and bringing the fitting atoms nearer. Their primitive, or real, and secondary forms are always to be distinguished in examining the structure or

layers of their particles with the microscope. In all crystallization, repose and pressure of the atmosphere are necessary.

The details of crystallization, like those of Chemistry, are of indefinite numbers; but all in subordination to general laws, applied to a few forms; and the details, though curious and amusing, are merely trifling.

Alum, dissolved in water, crystallizes as octahedrons ou evaporating.

Seleniate of zinc unites with three portions of water, and assumes three forms, according to temperature. Sulphate of soda at 90° crsytallizes without water, and at 60° with water in a different form. Heat, in general, much varies crystallization.

When water freezes, it forms itself into crystals, with interstices, and expands: hence, ice swims, and is eight parts in 100 lighter than water. Some metals and sulphur expand, when crystallizing, while other bodies contract.

Ice, in melting, absorbs as much heat from surrounding bodies as would raise the same bulk of water to 140°. And water, in passing from 32 into steam, absorbs as much heat as would raise the same bulk to 1000°. Hence, there is above seven times the atomic motion in steam that there is in water.

Tiles, stones, &c. break by water in them freezing and expanding.

Water in freezing, evaporates as much as by direct heat, and ice evaporates largely. As evaporation carries off the most mobile atoms, or heat, it produces coldness in the body.

Fordyce, Morveau, and Rumford, proved, that when the atoms of fluids become fixed by freezing, they increase in weight; since lateral motions of fluidity diminish weight. Davy and Berzelius state that the weight of an atom of azote is twice its specific gravity, as gas.

When the atmospheric pressure is removed under an air-pump, the rapid evaporation will freeze mercury, but the vapour must be absorbed by sulphuric acid, or some pulverized rock. This is Leslie's experiment, and it has been used to freeze water, cool wine, &c. &c.

Salt renders snow liquid, and the liquidity absorbs motion from surrounding bodies, so as to freeze them. Snow and nitric-acid do the same; and in mixture of lead 51, tin 30, bismuth 71, and mercury 404, lowers temperature considerably by their liquefaction.

In slaking lime, the water becomes fixed by combination, and the atoms exhibit their lost motion in the heat of the lime.

Metals solidify at higher heat than water, water than oil, oil than spirits and mercury, and, to become fluid, they require more heat respectively.

The evaporation of ether from the bulb of a thermometer will lower it from 40 to 25. A phial of water wrapped in cotton, and frequently wet with ether, will freeze, by the motion transferred to the vapour.

Water forms no crystals till far below 32° if kept very still.

Nine cubic inches of water become 10 by freezing, and hence its powers of bursting vessels, rocks, &c. in freezing.

Leslie's method of freezing water by the air-pump, consisted in absorbing the moisture by a saucer-full of oil of vitriol, and thereby having the expansion without the moisture. When the air is rarefied 250 times, water, under the receiver, is cooled down 120°. In this experiment, the motion which kept the water liquid is transferred to the sulphuric acid, and the water then fixes or crystallizes, but, if left in the rarefied air, it entirely evaporates after it has become ice.

The water should be freed from air, or its more mobile atoms by boiling. The sulphuric acid, or parched oatmeal, is capable of congealing forty times its weight of water, with rarefaction from 20 to 40.

Mercury may be solidified in the same manner, so as to bear the stroke of a hammer.

Leslie's experiment explains the principle of fluidity, and of freezing and gaseous construction. As the air is exhausted, the gaseous atoms have more room for their orbits, and, in consequence, the gases in the water expand, find room in the receiver, and leave the water. Then, as the water becomes ice, it is evident that its fluidity arose from the gas in its interstices, and that freezing is the departure of those gaseous orbits. Water increases its bulk in freezing, because the atoms, in separation, fill up the cubic space; but, when uniting in lines or superfices, they occupy more space; therefore, ice is lighter than water as 92 to 100.

The porous vessels, used for cooling wine, are of African origin, made in Spain, and called Alcarrazas. The atomic motion, or heat, in the water, is diminished by evaporation at the pores.

Another method of crystallizing is to expose powders to the atomic action, or motion, of positive and negative electricity (*i. e.* of oxygen and hydrogen in separation and restoration), and then, on the excitement abating, the atoms adjust themselves in regular figures, determined by their own forms and the atmospheric pressure, which in every case packs them. It is merely a case of the subordination of all matter to the relations and conflicts of the elements disturbed by motion (whether the mode of motion be called heat or electricity), followed by the surrender of the atoms to other powers, as that of relative form and atmospheric pressure.

The power of salt to lower the freezing point of water, is directly as to the quantity, and 1-10th lowers it 10°.

Alcohol has been exposed to 90, 110, and 120° below zero without freezing.

Sea-water freezes at 28°·3.

In freezing water the crystals join at an angle of 60°.

A cylinder full of water may be converted into ice, by placing it in 5 lbs. of sulphate of soda, and 4 lbs. of sulphuric acid, at 36 deg. well mixed. The ice is extracted for use by putting the cylinder in hot water.

In Bengal, the Hindoos make ice by evaporation, and ice-pits for use in hot weather. The Hindoos also cool water by mixing one part of nitre with two of water.

Melted snow produces about one-eighth of its bulk of water; hence, snow, two feet deep, produces three inches of water.

Quicksilver melts 39° below Zero.

Ether freezes 47° below Zero.

Wine freezes at 20°.

Extreme cold produces the same perception on the skin as great heat. When mercury is frozen at 40° below Zero, the sensation of the skin is the same as that of touching red-hot iron.

The greatest natural cold known, is 50° below zero.

If ice requires more motion to liquify it than the apparent increase of the resulting fluid, it is because the structure of ice demands a force greater than the simple ratio of heat. The breaking up of the crystalline structure, and converting it into fluid, may well require 140° of heat for an increased temperature of only 17°, or from 20 to 37°. The difference is no basis for a gratuitous theory, but is a proof that to overcome a force of structure, a force of atoms in motion was necessary. A hammer would at one blow dash a pound of water on every side, but it would require twenty or thirty blows to pulverize as much ice.

On cooling heated gas in a close receiver, it still fills the receiver, for the motion was in excess; and, if the receiver were not full, a vacuum would result, while a vacuum facilitates expansion and atomic motion. This fact, alone, proves that gases are created by orbits of atoms.

That the whole is an affair of structure to be overcome, and of power distinct from heat, is evident from the fact, that if 2 lbs. of water at 80° and 32° are mixed, the result will be a mean fluid at 56°. But make the lb. at 32° ice, and the extra 48° would not break up the structure, and cool down the whole to 32°. Nor does 32° produce a mass of ice, but from flakes at 32°, it is probable that the congelation involves cold below zero.

Liquids crystallize by cooling and freezing, because cooling and freezing imply the deprivation of that intestine motion which rendered the atoms a liquid; so vapours crystallize by their sublimation and fixation on quiescent surfaces, with which they come into contact, because at those surfaces they part with their intestine motion.

Every fluid compound, susceptible of the solid state, crystallizes, in exact geometrical forms, as results of equal actions and reactions.

Heat as a Machine Power.

On going to the top of a high mountain, where the weight of the air is diminished one-tenth, the boiling point of water is somewhat less than 207°. On going to the bottom of a deep mine, where the weight of the air is increased one-thirtieth, the boiling point of water is nearly 214°.

In a steam-engine, every nineteen cubic inches of water produces twenty feet of steam, or 1 to 1800 nearly; and this is equal to one horse, and produced by a quarter of a pound of coals. In general, a chaldron of coals works a hundred-horse power for four hours.

A committee, appointed by the French Academy to determine the elastic power or volume of steam at high temperatures, gave the following results:—

Elasticity of Steam.	Farenheit.	Elasticity of Steam.	Farenheit.
1	212·00	8	341·78
1½	233·96	9	350·78
2	250·52	10	358·88
2½	263·84	15	392·86
3	275·18	20	418·46
4	293·72	25	439·34
5	308·84	30	457·16
6	320·36	40	486·59
7	331·73	50	500·60

One cubic foot of boiler in steam-pipes heats 2000 feet of air to 70°; and one square-foot of pipe will warm 200 feet of air.

In Cornwall, certain steam-engines have lifted 40 million pounds one foot, with one bushel of coals; and one at Wheel Towan 62 millions with an 80-inch cylinder.

The advance on the power of Cornish steam-engines is chiefly owing to covers of slowly-conducting substances to the steam-vessels.

Watt's improvement of the steam-engine consisted in his discovery of the power of cold water to condense steam; and he applied this means in a separate vessel. Four ounces of water will, in a second, condense 200 feet of steam, and reduce their expansive force to one-fifth.

Scotch cannel coal produces the greatest proportion of illuminating gas; then Wigan, Wakefield, Staffordshire, Dean Forest, and Newcastle.

A ton of coals yields 8 or 9000 cubic feet of gas. Street-lamps consume 5 feet per hour, and Argand lamps 4 feet.

10,000 cubic feet of gas is obtained from a chaldron of Newcastle coals, or 500 per cwt. 11,000 cubic feet is produced by a chaldron of Staffordshire coals, or 550 per cwt.

Gas-pipes of half an inch in diameter supply a light equal to 20 candles, one inch 100, two inches 450, three inches 1000.

The gas which lights London is made by companies, who consume 50,000 tons of coal per annum, which make 400 millions of cubic feet of gas, lighting 62,000 in-door, and 7500 street-lamps. Various establishments make one-eighth more.

The gasometers of the London gas companies contain each nearly 20,000 cubic feet of gas, and some have 47 of them; and altogether 1315 retorts. The coals make one-fourth more in bulk of coke, which sells at about 16s. the ton.

Sixteen retorts will produce daily 50,000 cubic feet of gas, consuming five tons of coal in the retorts, and costing above five farthings for every ten cubic feet of gas while it is computed that this will give as much light as half a pound of candles. The

same quantity of oil-gas would cost $2\frac{1}{2}d.$; while the refuse in making the coal-gas is worth a fifth.

In burning anthracite, or hard coal, the furnace or chamber should be brick or stone, and not red-hot.

In 1830, the gas-pipes in and round London were above 1000 miles.

The degree of light in carburetted hydrogen depends on a due proportion of carbon, for pure hydrogen and oxygen give a very feeble light.

When steam is first generated from water at 212 deg. its force is that of one atmosphere, its density 1, and its specific gravity 1·26; but at 320 deg. its force is equal to six atmospheres; at 358 deg. to ten; at 416 deg. to twenty; and at 590 deg. to one hundred atmospheres.

Steam at 212 degrees, according to Count Rumford, is 3000 times rarer than water, or $3\frac{1}{2}$ times rarer than air; but great heat will raise it to 14,000 times the bulk of water, equal to five atmospheres. Taking 212 as 1, its force at 100 is ·962; at 260, is 2; at 290, 3; at 300, 3·337; at 330, 4·6; and at 350 is 8.

Steam at 343° of Fahr., equal to 8 atmospheres, raises the mercury 20 feet. A fifth increase of heat doubles elastic force.

Fifty atmospheres is produced by 510°·6. Mercury rises as atmospheres, so that as 1 atmosphere gives 30 inches, 10 atmospheres give 300 inches, and a half but 15.

A bushel of coals will convert into steam 14 cubic feet of water, occupying 1330 times that space as steam, and lifting the atmosphere above the water 1330 times its depth, or 39 millions of pounds one foot high, or with deductions 30 millions; susceptible of further increase by more fuel, carrying it above 212 degrees.

A vessel boils because the fire beneath fixes the atoms of oxygen, and these first impart their motions to the combustible, and then by this, to the bottom of the vessel, and by it to the fluid. The heat in the fluid is a condensation of the oxygen in the air as fixed by the combustible.

Many public establishments in London, and manufactories in the country, are heated by *hot-water pipes*, and some by hot steam. The economy is that of half the coals and double the heat, besides the luxury of its diffusion through a house or building.

Vapour of ether, at 64°, has a force only of 13 inches of mercury, but at 210 it is 166. So alcohol, at 55°, has a force of only 1, but at 200° it is 53: and at 264° it is 166. Turpentine, at 350°, is 53·8; and at 362° is 62·4.

Two iron plates, 4 feet in diameter, and weighing 1600 lbs., revolved 80 times in a minute, send heat sufficient, up a funnel, to warm a large factory. They are turned by a band and a water-wheel, and last for years.

Silvester's apparatus for distributing heated air kept the temperature of Parry's ships, between decks, at 60° to 70°; while above the deck the thermomer stood from 0 to 30°, with a consumption of only a bushel of coals in 24 hours.

One gallon of water, converted into steam, will raise six gallons at 50° to the boiling point, ($6 \times 162 = 972°$.)

One foot of surface of cast iron steam-pipe heats 200 cubic feet of air 70 deg.

Delaroche and Berger placed several species of vertebrated animals in a temperature varying from 108° to 113°, when most of them remained quiet at first, but after the lapse of half an hour they became restless and hurried. The result showed, that vertebrated animals in a dry air, heated to 113°, are near the utmost limit of temperature in which they can exist. After recovering the effects of this heat, they were removed to an atmosphere of from 134° to 144°, when, except one frog, they all died, between 24 minutes and 2 hours.

A young man remained 20 minutes in an oven, heated to 210° Fahrenheit. Berger and Blagden exceeded this, the former enduring 230° during 7 minutes, and the latter from 240° to 260°, 8 minutes. Delaroche could not remain more than 10 minutes in a *vapour-bath*, at 100°. Berger was obliged to get out of a vapour-bath at a temperature 122° in $12\frac{1}{2}$ minutes. The sensation in hot vapour resembles that of contact with boiling water.

Blagden, and others, in heated rooms at 289° experienced no inconvenience in respiration, and the heat of their bodies did not rise above $99\frac{1}{2}°$. Chabert entered an oven at 500°. But all metal acquired the full heat; water boiled, &c. Fish, too, actually live in hot-baths up to 158°. Trees also grow in a bath at 174°; flowers, near a volcano, at 210°; and water-plants are found in boiling springs.

The heat of an oven, applied to a dead human body for 12 days, reduces it from 120 to 12 lbs. The fluids are to the solids as 8 or 10 to only 1.

By atmospheric and solar heat, a sunflower weighing 3 lbs. loses or changes 22 oz. in 24 hours, and a man 2 lbs. by animal heat alone.

Water, in heating, makes two currents, one up the sides of the vessel, and another down the centre.

Count Rumford left 1000*l.* 3 per cent. annuity, the interest of which is to be disposed of every other year to the person who shall communicate any discovery on heat and light.

In raising temp. from 32° to 100°, gold springs lose 484 sec. in 24 hours; steel 385; palladium 155; and glass springs but 40 sec.

Aldini has contrived amianthas and wire-clothing for fire-men.

Four lbs. of beef lose 1 lb. by boiling, 1 lb. 5 oz. by roasting, and 1 lb. 3 oz. by baking; 4 lbs. of mutton lose 14 oz. by boiling, 1 lb. 6 oz. by roasting, and 1 lb. 4 oz. by baking.

A convex lens burns at 25 feet under the surface of the sea in a diving-bell.

Pits, in the Burman empire, yield four millions of gallons of petroleum, serving for

light, and, mingled with earth or ashes, for fire. Kentucky, &c. affords the same.

Candles, at 30° from the perpendicular, require no snuffing, and give uniform light.

Salt-water is evaporated in Italy by letting it fall on faggots, which, in dry weather, are covered with crystallized salt.

Count Rumford, at Munich, prepared a dinner for 1000 persons with only nine pennyworth of fuel.

In Wales, Scotland, Warwickshire, Staffordshire, Derbyshire, and many parts of Yorkshire, &c. &c. where coals or peat are cheap and abundant, kitchen and other fires are not allowed to go out for years. The fire is made up at night, and broken with the poker in the morning. Tinder-boxes, &c. are unknown in such districts.

A poker laid over a fire concentrates the heat of the passing smoke, and creates a draft through the fire.

Mercury, in a thermometer, means up to 500° of heat, but it freezes at 40° below zero.

The thermometer shews the same heat in vacuo as out of it, owing to the conducting power of the walls, &c. of the vacuum.

Humboldt thinks the heat of the air may raise the thermometer 130° or 140°; but others limit it to 115°, and to 88° over the sea.

Water is called hard, when, from containing too much carbonic acid, it holds lime in solution.

A phial of water, in freezing, parts with as much atomic motion as would make an equal bulk of gold white-hot.

Gas raised to 3 or 400° gives to the hand a frigorific feeling, probably owing to its being an approximate vacuum.

If a pound of ice, at 32°, be dissolved in a pound of water at 172°, the result is 32°. But, if the water be mixed with unfrozen water at 32°, the result is 102° or half. So that crystallization involves 140°.

Cases of planished tin enclosing hot bodies retard cooling, as 3, 5, 7, &c.

A cubic inch of frozen mercury, dropt into a tumbler of warm-water, instantly congeals it, by abstracting its heat from the water.

A degree of latitude, between 45° and 50°, is equal in heat and cold to 300 yards in elevation.

ELECTRICITY, GALVANISM, &c.

Electricity.

The Electrical Phenomena of rubbed amber were known to Thales, and, before his time, Theophrastus wrote at large upon it. Gilbert, in 1600, found that 20 other bodies had the same powers. Ho Guericke discovered the sparks, and Wall suggested, in 1725, the idea that they resembled lightning. Grey distinguished between electrics and non-electrics, conductors and non-conductors. Dufay established the distinction of vitreous or positive, and resinous or negative electricity. He also drew sparks from the insulated human body, and Gray from insulated metals. Hence, the invention of conductors by Boze, and of the cushion by Winkler.—The Leyden Phial was discovered by Mushenbroek and Van Klest, in 1774.

Electricity may be defined to be the principle oxygen, or hydrogen, placed in opposite position by certain excitements in a centre; and then in loco-motion, seeking re-union by mutual action and re-action. But, it is generally taught that electricity is a subtile fluid of its own kind, diffused through nature, but in excess in some bodies, and in deficiency in others; also that there are two fluids mutually attracting each other, and repelling all matter!

No subject has more promoted philosophical studies than the amusing mysteries of electricity. When the action was first discovered, ignorance of many connected subjects led to false theories out of number. The gases had not been discriminated, and when they were, the knowledge was not speedily, if it has, even after two-thirds of a century, been applied to phenomena which they alone produce.

The instant it was known that the union of oxygen and hydrogen produced light and heat, then the recognized division of electrical action into vitreous and resinous, afforded a clue to the cause. But, in the mean time, light and heat had been mixed up with faith in an absurd fancy called caloric! There was also a stumbling-block in Æpinus's mathematical analysis, though really as irrelevant as Galbianus's logical treatise on cookery, in which every dish was illustrated by set syllogistic forms.

In 1788, the Editor made a great machine with a conductor of parallel coated boards; and, by the simplicity of its action, shewed to the eye, that all electricity was mere simultaneous action and re-action; that there were two agents, one as worthy as the other; that neither by itself was electricity; and that when excitement (as at a centre) commences, there is an action and re-action all round towards the disturbed centre. The force of the correlative parts led to the interchange of light bodies moved with *less* force, a principle of much vulgar conjuring. In fine, the union of the disturbed force, or the restoration of the disturbance, gave light and heat; then what is it produces light and heat, but the rapid union of oxygen and hydrogen? He perceived, also, that the colour of his sparks depended on the carbonaceous surface over which they were taken, just as in all fires produced by oxygen, hydrogen, and carbon.

The perfection of these ideas was the discovery of the oxy-hydrogen blow-pipe, the means of evolving oxygen and hydrogen in voltaic arrangements with the similar light at the Poles, and the determination by Wilson Philip, that nervous action and electrical action are the same by which we explain the mystery of the spark.

Voltaism tended also to mystify, but, as the nitrous-acids decompose oxygen from one metal, and hydrogen from the other, and each of these are made the root of the

wires, which end in the Poles, the general principle is palpably the same; and then we have the proof, in that exaltation of light and heat, which alone resembles the light and heat of the hydro-oxygen blow-pipe, or the discharge of a battery over a surface of water. Identity cannot be made more complete; and it is an identity of agencies, in the universal elements of oxygen and hydrogen, altogether so reasonable.

Exceptions ought to be studied as such. For example, heat, as atomic motion, becomes an excitor; and roughness and smoothness, in the same substance, become excitors, from mere variety or difference of motion. In like manner, other gases may produce like effects, just as the factitious gas chlorine becomes a supporter, owing to the loose affinity of its extra doses of oxygen. The principle is not changed. We may, with Davy, create an excitement in a factitious gas, but the correlative flow of the electric elements takes place from all circumambient bodies in this as in all other cases, and the machine worked in the dark will shew this.

Electricity can, in truth, only be understood by seeing an extensive machine in action in the dark: we behold an immediate apparent flow of opposite principles at every point of interception all round. At each point it makes *a spark* not as light *per se*, but, because each point has its own negative and positive surfaces, or the contrary; hence the conclusion is false, that a fluid is proceeding from all the circumambient parts. If the surrounding bodies are continuous, no light appears; if separated a little, then we have a spark; but if much, then we only have *induction*, or an accumulation of the contrary element on the near surfaces; and such, *in all cases, is induction*. A definite or shortened mass, on either side of the excitement, shortens or destroys the whole effect: and, in general, the distant effect is as the circuit of surfaces affected. In perfect electrical action, the two sides ought to be able to collect equally. It is, in fact, a flow of action and re-action directed to and from the seat of excitement; and the apparent flow, by sparks, &c. outward, is a restoration of that which had flowed inward, *i. e.* oxygen to hydrogen, or hydrogen to oxygen: and we see it in links of chains, or in broken points of continuity all round, while the generation of the contrary element proceeds.

The flow of each element is caused by the first excitement in the centre. The sphere affected is great or small, in proportion to the excitement, and its continuance. We rub a glass plate or cylinder against a cushion of silk, and we increase the action by an amalgam, which, in oxydating, generates one of the elements. Points, by their susceptibility of acquiring the contrary state, then receive the contrary element; and, striking it, seek more general diffusion in the conductor. This again affects all surrounding bodies, and a balance is produced by general *induction*. In fact, a plate of air is charged, one side of which is the surface of the conductor, and the other side the walls and furniture of the room. It seeks those objects with force, and they seek it with force, as means of restoration; but, on the conductor, it is insulated. It is placed on bodies which are electrics, therefore susceptible of the action, and not its conductors; for perfect conductors are only those bodies which receive none of the action, and diffuse or spread it correlatively with other surfaces in the opposite state. It is then made to pass into glass-jars, but these expend it in their substance, and bring the *induction* nearer on the other side. At length, a neutral diffuser, or discharging-rod is applied to both sides, and in the dark we see the returning, or induced flashes at every interval of continuity.

The whole has been an action of oxygen and hydrogen, the generation of one demanding the other instanter, on the spot, and then around in concentric circles. The mutual and reciprocal excitement commences in a germ, perhaps, of the 10th of an inch radius, and expands around till the action is too much dilated to be sensible. There is a fitness in their union which can be understood only by seeing them, but it would not be difficult to hypothecate it hypotheses were allowable.

Thus far facts and the strongest analogies justify, at every point, the theory adduced, viz. that electrical action is the mere action of oxygen and hydrogen in separation, reunion, and restoration; that voltaism is merely a case where the generation of the two elements is in a narrow space, and the restoration immediate by the wires proceeding from the evolved elements, and that the jets of the hydro-oxygen blow-pipe are perfectly in point as to effect and analogy. In fine, that the three are direct means of generating such light and heat as identifies a common source in the agency, or action and re-action of oxygen and hydrogen. What a jumble would nature be, if there were co-extensive fluids for all its purposes and phenomena!

We appear to understand the union of gases; at least, we may do so by considering that the hydrogen fixes the oxygen, and that the heat is the motion parted with by the oxygen atoms; but, in electricity, we seem at a loss to understand how hydrogen and oxygen, as constituents of other bodies, are acted upon simultaneously at a distance. There is, it is true, a medium between, but how that is acted on, or how it acts, is not easy to conceive. But that a force is generated and acting, is evident from the passing and re-passing of bodies moveable with less force. We may also conclude, that the affinity for the substances opposed alters the effect; though, beyond question, some essence of hydrogen unites with some essence of oxygen, when the light and heat of the spark are generated; and, at the same time, the quantity is restored by the juxtaposition of other bodies and sparks from them all round. If there is no such power

of restoration, the substance permits no escape, unless the connection is loose, or the element in superfluity. Faraday, who adopts the Editor's theory in the main, may not be wrong when he supposed that the atoms in the space are oppositely polarized from each surface. The Editor had supposed strata on strata meeting, but polarization is a more *fashionable* phrase.

Many collateral proofs might be adduced in proof of the intimate connection of oxygen and hydrogen with electricity; for example, when the Poles of positive or negative evaporate into coloured fluids, they effect the same conversions and re-conversions of colours, &c. &c. as the gaseous elements. But how they affect many odd purposes and singular phenomena, it is as difficult to determine as to understand the theory of atoms. Hitherto, attention has not been rationally directed to the subject, and false theories, out of number, have misled all experimenters.

Galvanism is considered the same as electricity, but it resembles it only in a few circumstances. It produces great heat at the Poles, and little light without carbonaceous adjuncts. It appears, in fact, to be the concentration without the surplusage. It is generated, plus and minus, at minute distances, therefore gives no sparks or flashes, and it appears to be the concentration, which, preferring the better conductor of the wires, re-combines only, or chiefly, at the Poles. The same concentration fits it for the lateral action in its double current, which generates laminar electricity in iron and steel, called magnetism, in a circle plus and minus.

Every machine at work generates either oxygen positive, or hydrogen negative. If oxygen, then hydrogen accumulates on the opposed surfaces of all bodies around, and inductive action; and, striking by sparks is the consequence, and this is the light on all sides in the dark. The machine, however, is insulated, and induction alone exists as to it, till a perfect conductor is made to connect the acting and re-acting surfaces, and the effect is then destroyed by an explosion. When hydrogen, or negative, is generated, the oxygen flows in and produces the same circumambient induction, till a perfect conductor restores the two sides. The sources of the contrary element are the walls of a room, and all the objects around to an indefinite distance; for these elements exist in every thing, and respect should be had to the surrounding bodies and their connections, when electricity is desired.

The case of galvanic excitement is different. The two elements are simultaneously generated, and in such proximity as adds to their force, like the proximity of the two surfaces of glass; but, at the moment of generation, a perfect conductor is presented to each, and, preferring this to the imperfect fluid, they make its circuit or union. But, if this circuit be broken, and each wire made to lead only to the other, we then get a condensed double explosion, and all the energetic action of voltaic Poles.

The contrary action which exists in the two wires thus broken, of which each part performs a double office, positive to negative, and negative to positive, affects every conducting body around, and actually charges the laminæ of iron, when within a given distance from the wires, and also confers a directive force or polarity on the atoms of air, &c. within the sphere of action.

Such is machine-electricity, galvanic and magnetic.

We must, in these reasonings, guard against the error of assuming either of the forms in which the power of these elements is displayed, as the standard form. Neither the flow from the jets of the blow pipe, the noisy combustible form of the shaft of lightning, nor the silent action of the voltaic Poles, are other forms than what peculiar re-actions severally produce. There is a sort of kernel, a central, or focal point, which assembles the force, and acts on other bodies. The blow-pipe has its central point of action, the shaft of lightning creates but a very small hole, and the double burr, in a perforated card, has but a small orifice, though an apparent volume passes.

In the blow-pipe, and the machine-accumulations, we have less difficulty; but are not the same elements as palpably generated by the plates and fluids in the voltaic combination? Why those elements, and those only, if not to the purpose? Why the wires in each cell, so distinctive, if the elements in each were *foreign* to the result? It is uniform cause and effect. The very difference between it and machine-electricity explains other differences. The superfluous electricity around the voltaic apparatus, proves that both are the same; but the narrow space of generation, and the wires in immediate contact, give us the essence only, while the radiance is wasted, and the restoration or re-union by the Poles, or place of separation, decomposes, &c. &c. whatever intervenes. The + and — then pursue their circuit, and return to the troughs where fresh evolutions renew the effect. We do not see the passage and action, but we know, by many circumstances, that the power acts around the conducting wires. It is this which moves lateral wires, and this which acts by radii in a circuit on the *laminated* or torpedo-like structure of iron and steel.

The difference in the energy of the effect of mechanically mixing prepared oxygen and hydrogen, and re-combining them electrically, appears to arise from their indifference in one case, and in the other from their generating one another, and separating one another from a state of equilibrium, in preserving and restoring which all the power of space, in an indefinite circuit, was a guarantee. It is a disturbance of natural dispositions, to restore which, all the equivalent powers of nature are exerted.

The objects of the preceding observations are to shew, that there is NO ELECTRICAL FLUID, and that what has been so called is always the *effect* of the separation by ex-

citement, and the re-union by re-action of two well-known elements, always intimately connected with the bodies or substances which become ignitable or electrical. In a word, it is intended to prove that there is no electricity as an *ens*, or being, but only as an *effect* of the ACTION and RE-ACTION of elements excited into opposition, and then seeking re-union. The common effects, heat and light, and the admitted identity of certain of them with oxygen and hydrogen, lead, therefore, to the conclusion, that all combustion and all electricity, are only different modes in which those universal elements ACT and RE-ACT. Nor is this doctrine contrary to that of Davy, who, in ascribing affinity to different electrical powers in the substance, does but describe the affinity of universal oxygen and hydrogen, as positive and negative electricity, whose separation and whose re-union beget all the phenomena.

In all electrical reasonings, the correllative simultaneous action, positive and negative, should never be lost sight of. If we say any body or space is positive, we should bear in mind, that some other body or space is necessarily negative, and that both are acting in a sphere. All the confusion of electrical science has arisen from considering the cause as an entity, and not as an effect; and not *merely* an effect, but a *relative* effect; and, in fact, as two effects, always simultaneous, and absolutely necessary one to the other, like light and shade.

The taste of positive electricity is acid—of negative, alkaline.

When a compound of either oxygen, iodine, or fluorine, and another element is exposed to volatic action, the active element appears at the positive pole, and the other at the negative. The acid to the positive, and the alkaline to the negative.

Chemical affinity is governed by the positive and negative electric states of the bodies.

The theory of Æpinus and Cavendish recognizes principles of attraction and repulsion always impossible, and imagines circumstances, whose contrary is true. Never was mathematical science so abused, as in its application to these false and absurd data.

There have been overpowering mystifications on this subject, in the terms caloric, electrical fluid, &c. &c. Hitherto, Chemistry has admitted but one compound of oxygen and hydrogen, as 8 to 1 by weight, and 2 to 1 by volume, for water, while the nitrogen of the atmosphere is raised, in sensible products, by successive doses of oxygen, into the potent nitric acid; but, as oxygen and hydrogen are the parents of incandescence and heat, it seems not improbable that if 8 oxygen to 1 hydrogen, by weight, produces combustion and water, so an extra dose of oxygen, as 16 to 1, may produce Machine Electricity, and 32 to 1 Voltaic Electricity; the fluids being dispersed by the great heat, and the dispersion being the phenomena.

Both hydrogen and oxygen are the most abundant elements in nature. Hydrogen is 8-9ths of all forms of water; it is, with oxygen and carbon, part of all vegetables; and, with those of nitrogen, part of all animals; and that it is part of all metals is proved by their incandescence. Oxygen is still more abundant, being 1 5th of air, 8-9ths by weight of water, the component of earths, acids, salts, and of animals, vegetables, and metals; and its energy and activity equal its universality. What other substances then are so likely to be the components of combustion, and its protean forms of electrical display and voltaic power?

The electric spark which detonates two volumes of hydrogen to one of oxygen, loses its power when there is combined 12 volumes of air, 14 of oxygen or 9 of hydrogen, or when the atmospheric pressure is reduced 16 times. In fact, the spark acts like any other flame.

If an electric and a conducting substance are brought within a few feet of a positive prime conductor, the electric becomes negative on the near side, and positive on the off side, the influence penetrating its mass; but the conductor becomes negative on both sides, whether solid or hollow. If the electric is dipped in water or coated, both sides then become negative, like a conductor, proving that the influence penetrates electrics, and not conductors; and, also, that the air, positive on one side, and negative on the other, is an electric: and that, in effect, every conductor *is a mere coating to an equal surface of the electric.*

A non-electric, or conductor, is a physical surface in which the elements of oxygen and hydrogen are so intimately combined as not to be separable. An electric, or non-conductor, is a body in which the combination of the same elements are easily disturbed, and placed in correllative action and re-action on surfaces of adjoining non-electrics.

An electric does not conduct, because it receives, suffers, and exhausts the action and re-action.—*Phillips.*

A non-electric conducts or spreads the affection of the electric, because it receives and partakes of none of the action.—*Ibid.*

Of course, as no body is perfectly one or the other, so all bodies, in degrees, are electric or non-electric.

Electrics are like water-pipes with holes; and Conductors like perfect pipes, which permit no penetration.

We seem at no loss to explain the Light of Electricity, because, in the explosive mixture of 1 oxygen and 2 hydrogen, sudden compression produces incandescence as well as a flame applied, or red-hot body; and we may give credit to that compression, when the over-charged of two surfaces meet with electrical rapidity. Heat, or decomposing motion, of course increases with oxygen, on theory of increased proportions or doses. The charcoal points give off carbon and hydrogen, and these, subject to the heat of the fixed oxygen, cause the great light.

When we speak of the velocity of a spark, we are incongruous. No spark proceeds, or can proceed, from one surface more than from the other. It is the power of mutual approach that creates the spark, and the

negative and the positive become luminous when they unite, and each restores, at the same time, the opposed surface. This simultaneous condition is unavoidable, and is like the up and down of a balanced lever. To measure its velocity, is like weighing caloric, or raking for the moon in a pond.

The difference between the action of the oxygen and hydrogen, mixed in a blow-pipe, and the re-union in electricity, arises from the different circumstances under which they are separated. For the blow-pipe, we make them from zinc and manganese; but electrical excitement is separation of the co-mixture, by which they are united, with the force of space in space. The force of space then acts on each in the re-union, and this peculiar action and effect we call electrical.

All combustion is electrical, because it is the re-union of excited hydrogen in the combustible, with the oxygen in the circumambient atmosphere; and this, virtually, is all Electricity.

The negative and positive, or oxygen and hydrogen currents, unite at the *point* of union in sparks, whose colour and intensity is influenced by the bodies at the point, or by their atmospheres. Wood and ivory produce a spectrum crimson; silver leather green; powdered charcoal yellow; rare air green; condensed air blue, violet, and purple. These local atmospheres change the result, but the light is like other light.

A vacuum opposes *no resistance*, unlike all solids, and the supporter and inflammable principle unite in a scattered flame; but, in the discharge of a jar, a ball of intense light proceeds through the vacuum.

The ignition and explosion of a mixture of oxygen and hydrogen, on the application of flame, or red heat, exactly resembles an electrical spark, with this difference, that the rapidity stands in place of the flame.

Electric excitements are silently destroyed by various causes. 1. The degree of moisture in the atmosphere. 2. The angular points in the machine, or the apartment; and 3, the imperfect insulation. It lasts from half-an-hour to two hours, but a charged jar often retains dangerous force for some days.

The conducting power of a damp atmosphere to a dry one, is as three to one.

Points concentrate the action of large surfaces or volumes.

A conductor of coated paper is as powerful as one of solid metal; and hollow tubes pass charges as well as solid rods.

A thread of gum-lac has ten times the power of insulation of a dry silk-thread, and two and a half times more than a silk-thread covered with sealing-wax.

The brush and the star on points illustrate many electrical principles. The *brush* is the positive, or oxygen electricity, seeking equilibrium with activity through the inductive space; and in a dark room, from a fine point, it is a splendid phenomenon. The *star* is the negative or hydrogen electricity, receiving the oxygen, and effecting a neutralization or equilibrium. The light arises from the union with intensity of action, and the oxygen brush generates a force and current, which, in toys, amuse the vulgar.

Induction is between two opposed sides, and is most distant when air is the electric. But, in a Leyden phial, the inductive energy is within the solidity of the glass, which, in this case, is like the air. So, in galvanism, the inductive distance is a fraction of the distance of the exciting plates, owing to the intervening liquid being itself an imperfect conductor. The intensity is inversely as the inductive distance, therefore greater through glass the 8th of an inch, than through air at 10 inches, or as 80 to 1.

If any body, capable of being moved with less force than the force of re-action, is placed on either surface of a stratum of air, it is carried to the other surface, and said to be *attracted;* and, if the parallel plate of air is narrowed in any part by a projection of any kind from either surface, the entire force of action and re-action in the sphere is concentrated in that projecting part, and this concentrated force begets a sudden re-union of the sides, accompanied by heat, flame, &c.

If, after separation, the spheres are undisturbed, a silent restoration takes place, as the air is dry or damp, in ten or twenty minutes.

Restoration, therefore, consists in giving back to each sphere, through the centre, its abstracted oxygen and hydrogen.. And, when the restoration is made at points, or poles, through long wires, the wires necessarily extend the action through their whole length, generating a similar opposite sphere in the space around each wire, *for without such correllative action and such spheres there can be no excitement.*

Hot glass is a conductor, since the atomic motion, or heat, mingles its sides and prevents a negative and positive side. So, also, thick glass is a conductor, the obstructing substance preventing the formation of a negative and positive side. A coated bottle, containing boiling water, cannot be charged, till the water is cold or frozen.

Calcs of conducting metals, and ashes of conducting vegetables, are non-conductors, or electrics, owing to the weak affinity of the elements.

The passage of the spheres of action around the wires, in discharging a battery, produces a *lateral effect* on surrounding bodies, and puts light ones in motion.

Positive central action begets a negative sphere; and negative central action begets a positive sphere; and distant conductors, within the negative sphere, opposed to the positive centre, endeavour to become negative; and, within the positive, endeavour to become positive.

A conducting surface admits no excitement, and, therefore, extends or bounds the spheres of the first excitement. The insulated conductor of a machine, on its positive side, enlarges the negative sphere on its side, and if extended to the coated surface of glass, plane or jar-formed, the other side

becomes negative, as part of the first negative sphere.

Electricity of induction means merely the negation of one side of an electric stratum, or sphere, and of the bodies in it, when the other side is positive and the bodies in it, or the contrary.

In machine electricity, we have recourse to friction on the surface of a stratum perpetually renewed on the rubbed electric, and we provide an amalgam to be oxydated, thereby accumulated oxygen compels the hydrogen to flow in, to restore the equilibrium.

All excitement is by motion in some of its forms as by friction, blows, heat, expansion, contraction, fermentation, or oxydation.

Smooth glass, rubbed against woollen cloth, becomes positive, and the cloth negative; and so in regard to all the bodies, just as they follow and precede in the adjoining list—Smooth glass, woollen cloth, quills, baked wood, paper, sealing-wax, rough-glass, lead, sulphur, and metals.

The varied effect of smooth and rough glass proves that the effect is not in the substance; and the equal power of solid and superficial conductors proves the same. In fact, all electrical effects consist of disturbances of the adjoining electric, as the air, and in the fluid in galvanism, it serving as a less perfect non-electric than the metal slips which connect the plates.

Peroxide of lead is found to be the best non-electric. Poggendorf, who publishes the fact, by the common confusion of ideas, conceives that it contains more negative electricity than any other substance; but this is absurd; there is no negative, *per se*, and it is merely correlative to positive. Davy, Faraday, Delarive, &c. &c. make this mistake in every step. All electrical action is a separation within the electric space, and what are called conductors are boundary surfaces, more or less perfect.

The action of the torpedo has decomposed water, and made a magnet. The under surface is like the negative pole, or positive electricity; the upper like the positive pole of a battery, or negative electricity.

In the torpedo, the apparatus is near the stomach, and consists of a multitude of parallel tubes filled with a liquid. It can, at will, communicate real shocks.

Æpinus made a conductor of coated boards to charge a plate of air; but, in fact, all charges are charges of plates of air in effect, and powerful as the plate is more or less perfect. Round conductors produce but a minimum effect.

The body whose excited portion is of the least extent is generally negative. In other words, the body that is most affected by rubbing becomes positive, and that least affected negative. The harder of two rubbed electrics always acquires positive electricity.

In all electricity, the positive, or oxygen, is the active power, and this is confirmed by many experiments.

Coulomb proves that electrical action is inversely as the square of the distance, or, in other words, diffused or radiated. He determined clearly that the distribution of electricity on conductors depends *on the surface and shape, and that the force never entered the body.* When spheres are in surface, as 1, 4, 16, 64, or infinite, the force of action is as 1, 1·08, 1·3, 1·65, and never quite 2. And in 2 equal spheres in contact, the force varies from 30° to 180°, or as 0, 1, 4, 5, 6.

Coulomb determined the relative electrical force of twelve globes in line, and found the first to the second as 15 to 10; and of the first, to the sixth or middle, as 17 to 10. And, in twenty-four, he found the first and second as 156 to 100, and the first and twelfth as 175 to 100.

Cavendish calculated that iron-wire conducts electricity 400 millions times better than fresh water, and four millions times better than sea-water.

That machine electricity is so popular in its displays, arises from the breadth of its aerial stratum. That voltaic electricity displays so little, arises from its compact mode of generation. And that magnetic electricity acts only on iron, is because it is a power of the mere structure, and the same degree of power can act only on a similar structure. The poles of the three are alike; thus, a prime conductor is negative near the exciting cylinder, and positive at its extremity, where it is rendering all around it negative; a voltaic arrangement has also its polar ends; and so likewise a magnet; and in both cases, the same elements are operating, fixing, and exploding. The only difference is, that the voltaic elements were abstracted from elements previously in the natural force of union, and each by that force seeking re-union; and, in the latter, they were separately evolved from manganese and zinc, without previous relation, and brought together by mechanical agency.

The excitement of all electrical action being the generation of two specific spheroidal atmospheres, the restoration is also specific, and no other body or substance takes part in the restoration. Hence it is, that restoration is so indifferent to other bodies, unless they obstruct it, and then the affection is not elementary, but mechanical. A vacuum opposes no obstruction, and the restoration is the union of the inflammable with the supporter of combustion. Nor does any gas, or any state of air in the receiver, partake of the action, except as obstructors, or as patients of the intense action, by which they become heated, melted, &c. It is an act of mutual protrusion, in which other bodies are not connected in an electrical sense.

The experiments at the Royal Institution of London, and at the Institute of France on these subjects, are far less satisfactory than they might be, if they were not made in subservience to theories about fluids *per se*, which have, and can have no existence but in imagination. We read, with reasonable doubt, accounts of experiments, in which these *imaginary* fluids are said to run *through* wires and masses of metal, instead of *on or over* their surface; since we

know, that if the said solids were straws covered with gold-leaf, or pasteboard boxes so covered, the effect would be the same.

If the coatings are taken off jars or plates when charged, they only affect light bodies; but the renewal of the coatings gives the usual shock.

When we want negative or hydrogen electricity, we cut off the communication of the rubber with surrounding bodies, and give them a positive induction as to the insulated rubber, its conductor, &c. so that the rubber, &c. become negative by the positive induction all round. The phenomena, in the dark, resemble the other; but the action and re-action all round are positive, flowing inwards; and negative, re-acting by induction, sparks, &c.

The slight electrical flashes, often visible in a summer evening, are produced by storms at great distances, as 200 or 300 miles, and exactly correspond with the collateral sparks on all sides of the machine, whose distance is inappreciable.

The burr on both sides a card is occasioned by the opposite currents of oxygen and hydrogen.

A pound of red lead and a pound of sulphur, mixed together, are instantly separated by an electric current.

A clean plate of platina, immersed in a mixture of oxygen and hydrogen, in the proportion of water, concentrates them into water; and the motions of the gas, transferred to the platina, makes it red-hot.

Common, or aërial electricity, acts through ice by the body of air; but voltaic not till it has melted the ice.

The following are the results of M. Poullet's researches on the re-acting power of metals to electricity:—

Silver of 98 6	860
Red copper	738
Silver of 94·8	656
Fine gold	623
Silver of 80	569
Copper	224
Brass	194
Iron	121
Gold of 18 car.	109
Platina	100

The power is, also, in the inverse ratio of the length of the wires.

The re-action of different fluids, as to voltaic electricity, is exhibited in the following table, drawn up from experiments of Foerstemann. The *first* column indicates the quantity conducted by the substances in equal times; and the *second* the time, or seconds, for conducting equal quantities:—

Muriatic acid	2 464	0·410
Acetic acid	2·398	0·423
Nitric acid	2·283	0·438
Ammonia	2·177	0·459
Sol. muriate of ammonia	1·972	0·509
Sulphuric acid	1·737	0·575
Sol. potash	1·709	0·585
Sol. common salt	1·672	0·598
Sol. acetate of lead	1·560	0·632
Distilled water	1·000	1·000

Mr. Snow Harris, by delicate and perfect apparatus, determines that the impelling force on non-electric bodies, by the disturbance of an excited electric, is inversely as the square of the distance.

Wollaston induced positive sparks on a card coloured with litmus; and redness, as by an acid, was produced. But a negative wire soon reproduced the blue colour. Water, coloured with litmus, is changed in like manner.

The electrophorus arrangement is employed in Volta's Lamp, to light a jet of hydrogen, generated by a bar of zinc, with sulphuric acid 1, and water 7. A cubic inch lights a taper ten times, and gas from iron filings does not escape so readily as that from zinc.

The electric current acts laterally, so as to thicken and shorten bodies along which it passes, an 8th or 9th.

The heat which a discharge along copper and silver gives, is as 6, in gold as 9, in zinc 18, in platinum and iron 30, in tin 36, and lead 72. Hence, a discharge which fuzes 120 feet of lead and tin, will fuze only 3 inches of gold, and a quarter of an inch of silver, brass, and copper.

The human body, and all animal bodies, are electrical or galvanic combinations, and the excitement is the principle of vitality and energy. The surfaces oppositely excited are those of the lungs and the skin. The lungs fix oxygen, and are positive; while the skin fixes an equivalent, and is negative. The circulations, secretions, &c. are intermediate results, and the action of the heart arises from the proximity of the positive arterial blood with the negative venous blood. The action exhausts itself as it ought in the system.

In 2422 observations, different persons were 252 times externally positive, 771 were negative, and 339 imperceptible. In sitting at rest, Hemmir found himself 332 times positive, 14 negative, and 10 times imperceptible. Rest and action produce changes, owing to the varied effect of the lungs and skin, and the nervous system appears to act by a similar action.

Respiration renders the air of rooms negative when persons are at rest, owing to the lungs being in action while the skin is quiescent. School-rooms and sleeping-rooms become negative, while the external air is positive.

Closed windows are dangerous during lightning, because the inner side of the panes acquire an opposite electricity to the outside, and then any conducting body is likely to concentrate the action on the inside. Metallic bodies, picture-frames, coated mirrors, bell-wires, &c. display electricity, by induction, during a storm. The best lightning conductor is lead or copper, on the ridge of the roof, with perfect continuation of metal pipes into the ground.

Read, in 1790, found the atmosphere 241 times positive, and 156 negative, and, in 1791, 423 times positive, and 157 negative. In every 24 hours the strength increases and decreases

twice, and is weakest between 12 and 4,—but always varied by heat and cold.

The atmosphere is always positive in calm weather, but an electroscope in a wood is inactive, and out of it exhibits electrical action, the leaves and conducting vegetation operating to destroy the atmospheric electricity.

Crosse gives the circumstances which increase atmospherical electricity:—

1. Regular thunder-clouds.
2. A driving fog and small rain.
3. Snow, or brisk hail.
4. A shower in a hot day.
5. Hot weather after wet; and wet after dry.
6. Clear weather, hot or frosty.
7. A cloudy sky.
8. A mottled sky.
9. Sultry and hazy weather.
10. A cold damp night.
11. North-east winds.

The torpedo, the electrical eel, and some other fishes of the ray genus, communicate shocks on being touched by the hand, or by electrical conductors. The membranous organs, which produce this effect, are like the cells of a galvanic trough, or of a bee-hive, and very distinctly marked. The laminæ of muscles, and the fatty cells between them, are of similar kinds.

The shock of the torpedo seldom extends above the touching finger, and never above the elbow, but it can give 20 in a minute. The apparatus has a surface of 15 or 16 square feet, and the force so distributed is that of a very small Leyden phial. The fish is about 14 inches long and 10 broad, and it gives shocks only when irritated. One gave Spallanzani 316 shocks in 7 min. A torpedo, 4½ feet long, had 1182 plates or columns. Dr. Hunter reports on another with 470. The electrical eel possesses a more powerful electrical apparatus, and gives a decided shock, killing other fish by its power, and even creating a spark between metals which touch it. They are from 4 feet to 15 or 20 feet long.—*Phil. Trans.*

In bright lead and iron, the lead is positive to the iron; dull, the lead is negative to the iron and copper.

Solid and fluid bodies, passing into the gaseous state, produce negative and positive electricity as effects of motion.

Black and white silk stockings and ribbons, in contact, generate great electricity. The former require 1 lb. to 15 lbs. to separate them under different circumstances. Both exhibit very striking phenomena.—*Symmer.*

There are various methods of exciting electricity, as by turning a plate with great velocity; by heating different metals in contact, or by heating the same metal or substance differently. This last is called Thermo-Electricity. It has given rise to the Thermo-Multiplier, which, measuring minute quantities of electricity, in combinations of bismuth and antimony, estimates the heat that produces them.

Breaking certain electrics, as a stick of sealing-wax, produces positive in one end, and negative in the other. So with talc and dry wood.

Dropping powdered electrics on insulated bodies, produces excitement. As powdered rosin renders a plate negative, so, when the spoon is insulated, the plate is positive. Sulphur, glass, iron-filings, gunpowder, chalk, flour, &c. produced the same effect, apparently from mere friction with the air.

Haüy discovered that mesotype, boracite, calamine, prehnite, tourmaline, and topaz, become electrical by heat—boracite having 8 poles. The cause, the irregular forms of their crystals.

When melted sulphur is poured into an insulated metal cup, on cooling, the sulphur is positive, and the cup negative, for the sulphur has been oxydated by the air, and the cup is within its sphere, and negative. So a metal cup will acquire electricity from having a red-hot cinder dropped into it, because it is then fixing oxygen. And a platina cup, in which an effervescence of acid and chalk takes place, will display electricity by having involved in their electricity, the union of the principles of acids and alkalies, or oxygen and hydrogen, being electrical restorations.

Heating and cooling, melting and concreting, evaporating and condensing, expanding and contracting, dissolving and effervescing, propinquity with difference of heat or motion conducting power, so air, or acids, or alkalies, or water, lying between the surface—generate electrical disturbances.

Melted wax, rosin, sulphur, &c. display no electricity while heating and hot, but much when cold. Heated, a spark sets fire to them.—*Gray* and *Winckler.*

The spark from a kite is never above the quarter of an inch, and acute like the phial or galvanic charge; and, for like reasons, the proximity of the surfaces (earth and air) excited.—A kite is always dangerous, and should not be held by the hand.

The sound of thunder may be heard for 20 or 25 miles, or, with the ear to the ground, much more. Lightning is reflected 150 or 200 miles.

There is no thunder and lightning within the Arctic Circle.

In May, 1752, Buffon and Dalibard ascertained the identity of electricity and lightning by insulated rods; and, in June of the same year, Franklin made the same determination by a kite.

In July, 1752, Romas, of Bourdeaux, also constructed a kite for the same purpose, and made splendid discoveries with it, before the experiment of Franklin was heard of. Wall, Gray, Nollet, and others, had for years proclaimed the identity, but without experiment. During thunder-storms, Romas obtained sparks like flashes of 9 or 10 feet long, from the string, around which metal wire was wound, to the height of 1000 feet.

In a thunder-storm the clouds are mere non-electrics, or conducting surfaces, positive with a negative sphere extending to the earth; and the discharge at a point from one large surface to the other is the lightning; or the earth is negative, and the clouds

correlatively positive. All bodies in the *sphere* of action are affected, and the stroke produces an extensive *lateral action* in all conductors, and affects all combinations of oxygen, &c. with weak affinities, as beer, wine, &c. which require the protection of conductors. The cloud, the air, and the earth, resemble the zinc, fluid, and copper, in a galvanic combination.

Flames of pure hydrogen, wax, oil, and alcohol, conduct positive electricity.

The flame of a candle placed between two balls, negative and positive, surrounds the negative ball, and makes it hot. The flame seems, therefore, to be positively electrified.

The flame of carbonic oxide and of phosphorous go to the positive ball, and are negative; but others go to the negative, and are positive.

Charges sent through a chain or wire shorten it, and thicken it by lateral expansion. They clean a chain or wire from electric substances, explode water, make a depression in soft substances, and an impression on hard ones—all the effect of the lateral hemispheres which accompany the two currents.

Star-like figures of exquisite beauty are made by sprinkling rosin on electrified plates, and are varied by giving to any part an opposite electricity. The plates are 5 lbs. of rosin, 8 oz. of bees'-wax, and 2 oz. of lamp-black, melted and spread on a flat surface.

All the metals in fine wires may be oxydated by high charges passed through them in a close vessel. The air loses its oxygen, but if hydrogen or nitrogen is substituted, no oxydation takes place, but only separation of parts, proving that the currents themselves are neutral in chemical action, and that the oxygen is derived from the air by the great heat of the wires, produced by the mere mechanical action of the wires.

In like manner ores may be de-oxydated, quicksilver produced from cinnabar, and quicksilver and sulphur from their vermillion. This, too, must be the effect of mechanical heat, for the constituents of the current must maintain their identity in all cases. Water is decomposed on the very same principle.

Cavendish passed sparks through 500,000 grains of hydrogen, with 1,250,000 grains of air, and obtained 135 grains of water. He then exploded 19,500 grains of oxygen with 37,000 hydrogen, and obtained but 30 grains of acid liquor.

Singer, by exploding oxygen and hydrogen, produced water; with air and hydrogen, water and nitrogen. With chlorine and hydrogen, muriatic acid. With this last and oxygen, chlorine, &c. &c. Then, by exploding muriatic acid, he obtained hydrogen and fluoric acid.

Many bodies retain for different times phosphorescent light, by charges through them, as spar, chalk, lime, amber, crystals, &c.

Eggs, exposed to an electric current, may be hatched in a few hours, and pure rain-water may, by the same means, be filled with insects.

Watson fired inflammable air and spirits of wine by the spark. The smoke and flame of electrics he found to be conductors. In 1747, he produced a shock by making the breadth of the Thames part of the line of communication, and afterwards this was extended to 8000 feet of the New River, and 2800 feet by wire on land. The distances were afterwards increased to 12,276 feet, with perfect and instantaneous results. Not wonderful, because the true distance was but that from the inside to the outside of the glass, and the length of the communication was indifferent. The excited glass generated two proximate hemispheres, which the wires merely extended, and the junction destroyed the hemispheres, while the electrical action passed only through a distance equal to the distance of their diameters.

An insulated cat loses 65 or 70 grains in 5 or 6 hours, a pigeon 35 or 38 grains, and a sparrow, 7 or 8 grains.—*Nollet.*

In 1753, Professor Richman, of Petersburgh, was killed by a stroke of lightning, while superintending some observations on the effects of a storm on some elevated conductors.

The great battery at Haerlem consists of 100 jars, with 550 feet of coating.

The best preserver against lightning is a lead or copper ridge, instead of tiles on a house, and a perfect union of it with lead or metal spouts down the ground. Rods raised above a building are altogether dangerous, especially if oxydated.

Ruppel, a late travelier, asserts that the violent effects of the Kamsin wind are electrical. He also asserts that the accounts of caravans being destroyed by them are altogether fabulous.

In the Deserts all electric substances crackle on the least excitement. Horses' tails, in beating off flies, become electrical.

Electricity, in excess or deficiency, disturbs the formation of crystals; and a thunder-storm has accelerated tardy crystallization.—*Paris.*

M. Pontus, of Cahors, in freezing a phial of water, with a small tube joined to it, by ether, under an exhausted receiver, found that at the moment of congelation a spark of light proceeded from the small tube. The principle explains some polar and other phenomena.

When a capillary tube of water is fitted into a phial of water, and both are frozen, a flash of light proceeds from the capillary tube. When crystals are formed, flashes in like manner proceed from them. When water is frozen into hail in the atmosphere great electrical phenomena take place, and the hail is usually accompanied by flashes of lightning.

It has been considered probable, by Sir H. Davy, that the power of electrical attraction and repulsion is identical with chemical affinity. If this be true, we can explain the action of the electric and galvanic fluids, in

disuniting the elements of chemical combinations; for it is evident, that, if two bodies be held together by virtue of their electrical states, by changing their electricity we disunite them. But, in this view of the subject, every substance is supposed to have its own inherent electricity, some being positive, others negative, which is true only in a certain sense.

The perfectness of the chemical affinities, or union in exact definite proportions, seems to constitute the class of non-electrics; and electrics appear to be bodies of various degrees of loose affinity, or those in which bodies of loose affinity combine. Hence, there is no electric action, or elemental separation, in the best conductors or obstructors.

Berzelius says, that the heat and light of powerful combinations, are consequences of the simultaneous electrical discharge.

The bodies susceptible of electrical decomposition, are binary compounds in single proportions of their elements; for, as the contrary forces are equal, they effect only equals in composition. In fact, electrical decomposition is a test of chemical equivalents in single proportions.

In explaining electrical action, Faraday introduces a mysterious power as acting *on* oxygen and hydrogen, and does not ascribe the secondary action to them, and the primary to motion; but this change is no advantage to his theory.

Faraday promulgates, in 1837, that in all electrical actions the proportions of oxygen and hydrogen are the same as in water.

The substance of what is expressed above has, in sundry forms, been published full 30 years, though pains are taken to refer it to some obscure publication of one Grotthas, in 1804. The author of this British Theory, however, utterly disclaims a theory founded on attractive and repulsive poles, as repugnant to natural action. The flash of light which accompanies congelation, crystallization, and the lightning of hail-storms, are a train of facts, which, as well as induction, are not met by Dr. Faraday's theory.

All the attractions and repulses of electricity, and its modes in galvanism and magnetism, arise from the solicited re-union of the elements, whose separation produced the electrical state. An appeal to these, in proof of attraction or repulsion, is a wilful fraud on common credulity. Of course, as the bare idea of attraction and repulsion is absurd, so the theory of Boscovitch and all other theories are idle fancies.

Since non-electrics are mere obstructors, it does not signify what they are covered with, whether varnish, wax, &c.

MM. Henry and Ten Eyck have made an electro-magnet, with copper wire and cotton thread round iron, so as, with a battery of 48 feet, to raise nearly a ton weight.

Decisive experiments prove that electricity is developed by contact alone of different metals, without chemical action.

The great problem of Electrical Philosophy will be so to arrange the action of the elements, as to produce a steady light for general purposes, without the use of any combustible material.

Galvanism.

As Machine Electricity derives its power from the flow of hydrogen towards an oxygen excitement, or of oxygen to a hydrogen excitement, and depends for its supply on the variable character and connection of surrounding bodies, so voltaic or galvanic action is maintained by the proximate or assisted evolution of the oxygen and hydrogen, on the spot, so as to assure an immediate reciprocal supply, in fit proportions.

An acidulous fluid is placed between two plates of differently oxyduting metals, by which it is decomposed into its constituents of oxygen and hydrogen, in proximity, each in its fit proportions. The acting and imperfectly-conducting fluid might, in time, restore, but perfect conducting wires are connected at once with the evolution; and, through them, complete restoration is effected. But, for experimental display, the wires do not run round from plate to plate, but are too short, and then are united *near* their ends. The intermediate space, therefore, displays the energies of the double current, and that intensity of action, on interposed resisting bodies, for which this species of electricity is so remarkable.

As the generation is in so narrow a space with a power of restoration through the fluid, but instantly divided by better conductors, the power is intense, just like common electricity, when brought near by thin glass, as compared with a plate of air. It consequently gives no spark, has no points, does not act on light bodies, has no distant induction, but is mere local elemental power seeking its usual re-union or union. There are those who ascribe all this energy to an unknown substratum of power, or sort of essence of the oxygen and hydrogen; but science has not reached it, and it is a subject not adapted for discussion in this place.

Many plates, acting ultimately through one conducting wire, of course multiply the force at the poles, and, by the energy of the motion of the combining elements, decompose and disperse every refractory or opposing substance placed between the poles. If the union is made over charcoal, the incandescence, aided by the carbon, produces the most intense heat yet known. If the double current is made to pass over magnets, it changes their direction; and, if near unmagnetized needles, it renders them magnetic. This is Galvanism, or Voltaism.

It is impossible to praise too highly the great merit of Dr. Faraday, in his elaborate experiments on the several branches of Electrical Science. But it is impossible to detail his curious manipulations in fewer words than he has done, and these would extend to a bulky volume. If we understand him rightly, his general conclusions, in 1838, are very similar to those of the Editor so long since as 1788, when he felt assured that the whole was the correllative play of the univer-

cal elements of inflammability, and the supporter of combustion. This theory has been published in many popular works, during the last 30 years, and it seems now to be confirmed by the ablest course of experiments ever made, and by which Dr. F. has made the theory all his own. There were no want of facts in proof, but they were isolated, and mystery still, however, hangs over the cause of the force of re-union. At present, however, we must receive it as a fact, that uncombined oxygen and hydrogen always excite each others activity, and unite with the force and heat of the hydro-oxygen blow-pipe.

The electro-chemical theory is a mistake, because there is no electricity *per se*, either positive or negative. Electricity is always a relative excitement of two non-electric surfaces, in an intervening electric, and either surface may be negative or positive.

Faraday likens voltaic action to an axis of power, having equal and opposite forces, and the force which effects decomposition is in the body, and not in the poles. The action he represents by a double circle, the two forces moving contrary-wise, and carrying with them the parts of bodies through which they move.

The constituents of metals so vary, that zinc combines with oxygen more rapidly than copper; and, hence, if zinc be immersed in water, the fluid is decomposed; for the oxygen in the water being fixed by the surface of the zinc, the hydrogen in union with that oxygen is extricated, and it escapes in bubbles. This, then, gives rise to voltaic action, which is the mere effect of this action of an oxydating metal on a fluid in juxtaposition; for, as inert or fixed elements do not act on one another, but only on the gaseous or fluid states, so in this case of correllative action, there is no action in the dry zinc on the dry copper, or in the dry copper on the dry zinc; but the energies displayed arise entirely from the active state of the elements, in the intervening medium, as fluid or as gaseous.

Chemical and electrical affinities are now regarded as the same.

The absolutely insensible transfer of the two elements, in decomposing water, or its appearance by the galvanic circuit, when the poles are even 46 inches asunder, arises from the fact that positive electricity is oxygen, and negative hydrogen, separated, in the wires, in the fundamental proportions of water. For this inference, no other experiment can be requisite.

To understand voltaic excitement, we must attend to the connection made by slips of metal, from the copper of one pair to the zinc of the next. It is obvious, that if the zinc and copper, in one cell, acquired opposite electricities, a restoration would take place through the fluid; but, as metal connectors are better conductors than the fluid, so the *difference* of the excited electricity is conveyed, by the metal slip, from the copper to the next zinc. By this means the next fluid oxydates the zinc more rapidly, and more hydrogen is detached to the second copper. This, again, is connected with the third zinc by a metal slip, which renders the next zinc more oxydable, by the difference between what is carried back by the liquid, and forward by the metal.

Combustible substances, metals, and alkalies, go to the negative wire, *i. e.* to the proper zinc end; and acids and oxygen go to the positive wire, *i. e.* the proper copper end, and thereby restore the desired equilibrium.

Of course, as the force of a battery is increased by acceleration, the intensity increases with the number of repetitions, and the quantity is as the size of the plates.

The experiments with the Royal Institution galvanic battery, prove that oxygen may be detached from the alkaline earths, and a pure alkali be the result.

When voltaic currents pass through wires in the same direction, it is as though each current was the same; and, in seeking to unite, the wires merely obey the similar tendency of the currents. When in opposite directions, the phenomena are contrary and the wires separate.

There is a rapid absorption of the oxygen of the air, around every galvanic apparatus, as appears by immersing a glass jar over a pile, and the air so disappears that the water rises, and the oxygen in it is gone. Also, if a pile is placed in an atmosphere of oxygen, it absorbs the whole and the action stops, but may be revived by admitting oxygen. In this respect it resembles combustion and animal respiration. If kept close, with poles united, for some days, the chemical action re-acts, and particles of the copper and zinc are reciprocally carried through the cloth to each other, and the whole is almost inseparable; but, if the poles are not united, the copper is clean, and the zinc only blackened.

A Leyden phial may be charged by galvanic electricity, because the thickness of the glass is not greater than the distance of the plates in the trough. Charged glass approximates galvanism in intensity.

The galvanic discharge will force water through a membrane, from one part of a vessel to another.—*Porrett.*

The respective powers of metals, in forming a galvanic circle, are,—zinc, tin, iron, lead, copper, silver, go d and platina. That is, zinc oxydates and decomposes the intervening fluid and its elements sooner than tin, tin than iron, and platina is the slowest in receiving oxydation from the acidulous fluid. Amalgam of zinc, *i. e.* zinc and mercury, used in electrical excitement, is more readily oxydated than zinc. And cadmium follows tin, bismuth iron, palladium and tellurium silver, and charcoal stands between gold and platina.

Galvanism is a universal effect of all bodies in apposition, both of which have different affinities for heat, or for oxygen. Hence what is called thermo-electricity, and all the phenomena of resinous and other plates, when approached or super-heated. Hence the galvanic action of the earth, from the heat of general pressure, and the

galvanism of rocks which generates the ores and fibres of metals in countless ages.

The force is accelerated, if a second copper-plate be joined to the zinc, and a second zinc plate opposed to that—the indefinite repetition creating a voltaic battery, whose power depends on the number of alternations; and the zinc end, as flowing *from*, is as to the arrangement the *positive pole*, and the copper end, as receiving, the *negative*.

Different acids or fluids vary the powers. Iron in acids is positive in regard to lead, copper, &c. but negative if alkali is used. One metal, with two fluids of different strength, gives out positive electricity to the fluid which oxydates it the quickest. Other bodies besides metals also form weak circles; and muscle and brain, or muscle and nerve, form effective circles.

That galvanic as well as electrical transmission is in the space without the conducting-wire, is evident from wire carrying with it to the pole elements through which it passes, and which do not penetrate the wire.

The pieces of charcoal on which the wires or poles are twisted for light, should be 2¼ inches thick, and be box-wood charcoal, a good conductor, and kept in a stopper-bottle. The wires of copper.

The junction of the poles is exactly similar to the discharge of a Leyden phial. The electricity is in exactly the same state in a voltaic battery, and in a charged jar; but in the battery it is generated by the fluid, and *continuous* in its action.

The positive pole of a voltaic battery is that end which the zinc plates face; and the negative pole is that which the copper or silver plates face.

A large battery is 100 pairs of plates four inches square, but one trough of 10 such pairs, or 40 of one square inch, effects most purposes. Poles of 20 zinc and copper with moistened flannel are very powerful. The zinc is the positive and the copper the negative pole, taken any where in the trough or pile. The agent is the fluid in the troughs or flannel.

To increase force, a copper-plate is often opposed to each side of the zinc, and the battery consists of one of zinc and two of copper; and sometimes several zinc plates or copper are united.

Voltaic heat and fusion is quite independent, because the force is that of the oxygen and hydrogen, generated in and by the apparatus itself.

Galvanic effects are more sensible on vigorous small plates than on large ones.

In common electricity, oxygen always attaches itself to the surfaces vitreously electrified, and the oxygen moves to the vitreous pole when substances with which it has been united, as in oxides, &c. are carried to the resinous pole. Thus Davy produced the alkali potassium at the resinous pole, and oxygen gas at the vitreous; just as Gay Lussac and Thenard have since done the same chemically.—*Biot.*

When the zinc and copper are united as a double plate, with fluid on each side, the wires begin and end the series and the fluid, makes the zinc side positive, and the copper side negative.

In a battery of 40 pairs of 3-inch plates, charged with 200 water, 9 oil of vitriol, the battery lost 186 4 equivalents of zinc for the equivalent of water, decomposed in the Volta electrometer. With 200 water and 16 muriatic acid 152. 200 and 8 nitric acid, only 74 16. The two first evolved much hydrogen at the trough—the nitric none. 9 sulphuric and 4 nitric gave 111 5; and 9 and 8 gave 90·4. But 16 muriatic and 6 nitric gave 81·4. Faraday prefers 200 water, 4·5 sulphuric, and 4 nitric.

No copper is dissolved. Zinc should give no gas, and new plates be preferred.

Chemical action between a fluid and a solid, is always connected with the disturbance of electrical equilibrium, or of oxygen and hydrogen. When zinc is oxydated, the metal becomes negative, and the fluid positive. It continues, of course, only while the oxydation is proceeding; galvanic action depends, therefore, on the chemical power.

Every oxydable metal, or metal acted on, is positive with regard to the metal which is oxydable, or acted on, in a less degree.

Silver, copper, iron, tin, lead, zinc, become positive by contact, the latter with the former; and negative in the order of precedence. All non-electrics have the same properties, but it does not prevail between them and liquids; and, hence, the circuit.

Among the fluids for galvanic excitement, equal parts of sulphuric and nitric acids to 24 times their weight of water, is recommended by Young; but, by De la Rue, sulphate of copper only. But the best acid solution, for the excitement of zinc and copper plates, is 100 water to 2 sulphuric and 1 nitric acid.

That of two metals which transmits electricity with the least loss of intensity, is positive with respect to the other.

The best test of conducting-power is a piece of zinc and silver, laid above and under the tongue. Contact at the edges gives a taste, and then, if a conductor is interposed, the taste is renewed; but, if a bad or non-conductor, there is no taste.

When tapered pieces of charcoal are fixed to the poles of a powerful battery, and brought near, the light is so intense that all the elementary atoms in the air seem to be excited as by solar light, and bodies placed in the stream are instantly melted, vitrified, dispersed, or decomposed. The stream, being quite independent of other bodies in lateral proximity, takes place in a good vacuum in azote, chlorine, &c. in water, alcohol, oils, &c.

Atomic motion, or heat, is another consequence. A wire joining the poles will boil water. The troughs become heated from the negative to the positive pole. Iron and steel wires are fused, and that of platina heated to red or white heat. Thin leaves of metal burn with colours, as gold, bluish, white, and a brown oxide; silver, emerald-green, and dark grey oxide; copper and tin

like gold with red sparks; lead, purple; zinc, white with a red fringe; and mercury emits sparks. Oils, alcohol, &c. are set on fire, and gunpowder exploded.

Water in a tube is decomposed into oxygen and hydrogen by the poles; and in wires of oxydable metals the positive pole becomes oxydated, while the negative gives out hydrogen.

Owing to the limited sphere of induction in the cells, 1000 pair of plates are requisite to make pith balls diverge, and affect an electrometer.

Neutral salts are also decomposed in two connected cups by the poles, in each the acid going to the positive cup, and the earthy alkaline or metallic bases to the negative cup. *Davy*.

If three cups are connected by moistened asbestos, the middle one filled with sulphate of potash, and a blue infusion of potash in the others, then, on the positive pole being put into one cup, the acid from the centre will pass into it, and render the blue infusion red, and the alkali passing into the other will render it green.

In metallic solutions the metal passes to the negative wire in crystals, and the acid into the positive cup.

In a solution of nitrate of silver in the positive cup, and water in the other, a film of silver appears on the connecting asbestos.

If the first (positive) and second be blue infusion, and the other sulphate of soda (negative), the acid passes through the middle cup, and reddens the first cup, rendering it acid. And, by reversing the poles in such cups, the alkali will pass through the middle cup, and render the first green.

All these phenomena are to be ascribed to the lateral action of the currents, which extend the direct action, and give a current of motion to all the similar elements in the course of the travelling sphere round each wire. In some of the instances the poles concur, and in the middle cups the discharge meets. The transmission of elements through one another is similar to a ball passing through a door without moving it.

Sulphuric acid, phosphoric acid, ammonia, oils, alcohol, &c. have also by like means been resolved into their constituents; but it merits notice that all the effects relate entirely to oxygen and hydrogen, serving as a proof that oxygen and hydrogen are the two elements of all electric action.

The muscles of an animal may be excited after death in a surprising manner by galvanism, proving that muscular motion in life is produced by similar natural excitement. Thus, the wires of a battery inserted in the ears of an animal will produce motions of the eye-lids, mouth, &c. The muscles of the whole of a dead body may be made to contract in like manner.

Linari, by a helix, has obtained a spark from the torpedo.

Sparks have also been obtained from Nobili's thermo-electric pile of 25 elements. The helix was 505 feet.

In 1800, Nicholson and Carlisle decomposed water, by the action of the Voltaic trough, with its poles in water. Cruikshank and others, in operating on other substances, shewed that the alkali always was found at the negative, and the acid at the positive pole.

Wheatsone with a pile of 33 elements of bismuth and antimony, in a cylinder of ⅜ inch diam. and 1·2 long, two thick wires with a spiral of copper ribbon 50 feet, and one face heated with red-hot iron, and the other cooled with ice, produced distant sparks. Botts and Antinori had done the same.

Binks proves that the maximum power of a voltaic arrangement, is either when the copper surface is to the zinc, at 1 inch apart, as 16 to 1, or the zinc to the copper as 7 to 1. Equal copper and zinc is a standard 1; but copper 2, and zinc gives 1·3, and copper 16, zinc 1 gives 4·6. More copper causes decrease. So zinc increased from equality 1 to 7, gives a force of 3, and further increases of zinc diminish. Both surfaces were exposed to dilute sulphuric acid, but 1 zinc opposed to the copper is the same. It is 1 by weight of oxygen to 2 by weight of hydrogen.

That elaborate electrical philosopher, Mr. Crosse, of Broomfield, in his experiments with voltaic poles in sundry fluids, has generated on the wires in the fluids, even when one of the poles is in a porous vessel, a very active *acarus* resembling a porcupine in miniature. He first produced them on red volcanic porous oxide of iron, which he subjected to droppings of silicate of potass, (2 oz. of powdered flint, and 6 of carbonate of potass, intensely mixed, and heated in a black lead crucible, in an air-furnace) mixed with boiling-water, and fixed on each of the sides of the porous stone, the positive and negative poles of a water battery of 19 pairs of 5 inch zinc and copper plates. His object was to form crystals of silica on one of the wires, but on the 14th day he saw projections on the volcanic porous stone, and on the 26th these became perfect insects, standing erect on their tails near where fell the drops of the silicate, and on the 28th they moved about on 6 and 8 legs. 100 were afterwards generated. The silicate and porous brick also produced them. He afterwards produced them in long time, in glass cylinders, at the edges, in nitrate of copper, sulphates of copper, iron and zinc, and dilute hydro-chloric acid. Their numbers were great, and covered his apparatus. They shunned light, and winter killed them. No subject ever excited greater general interest, and Mr. Crosse varied his materials, &c. to satisfy incredulity.

When the Editor viewed Mr. Crosse's apparatus in September, 1836, he had 2500 pairs of voltaic plates, in 12 or 15 several working arrangements, all excited by water, and acting for months and years.

Becquerel uses a balance in electricity, which measures less than 0·015 grain. Water, in two plates of 1·6 inch, gives 0·385 grain. A drop of sulphuric acid gave 0·546 grain. A pile of 40, with the usual solution, gave 9·471 grains.

By the slow, constant action of a pair of plates, Mr. Bird has obtained beautiful crystals of copper from the sulphate; also of bismuth, lead, and silver, the latter white as snow, in needles. The most refractory metallic oxides, as silica, were also reduced by this simple apparatus.

Mr. Crosse, in his own original way, at his vast laboratory on the Quantock Hills, has latterly superadded great heat to his oxides, and thereby has increased the quantity and size of his crystals in an astonishing manner.

Becquerel and Crosse have independently proved, that slow voltaic action will produce metallic sulphurets and compound metallic crystals; also quartz crystals, so as to place, beyond doubt, the theory which the Editor promulgated in former editions of this work, that metallic ores are electrical products.

The subscription voltaic battery of the Royal Institution, with which Davy operated, consisted of 2000 pairs of plates, each 32 square inches.

Children's battery was 20 pairs of copper and zinc, 6 feet long and 2 feet 6 inches wide. Hare made coils of 70 and 100 feet of each metal.

Schoenbein, in some excellent experiments, shews that nitric acid 1·35 (unless much diluted with water) does not affect iron wires, which have been heated at one end, and that end immersed. The neutrality is also communicable to other wires touched with the first, except when much diluted. And if a wire, not thus protected, is partly immersed, and the acid begins to act, the action is arrested if the ends of the two wires, out of the acid, are made to touch, and any other metal employed to join them effects the same purpose. So, also, a platina or gold wire, and, also, an iron wire used as a positive pole is protected. The same wire, in contact with the negative pole, is no longer protected. No facts more clearly prove that electrical action is chemical, as far as regards oxygen and hydrogen, or nitrogen; and farther, that nitric acid is at once a chemical and electrical combination. Faraday has kept iron wire, thus protected in nitric acid, for 30 days, without any effect. When in the neutral state it does not precipitate copper and other metals. Schoenbein appears to have opened a new field in this science.

Hatchette's dry pile consists of pairs of plates, separated by a farinaceous paste and salt. It acts for years, but gives no shock or taste, or chemical action. Zamboni's discs of gilt-paper and a layer of powdered oxide of manganese, are as inefficient as Hatchette's. Biot attempted another, but failed, since chemical action only takes place between fluids and gases.

De Luc's electrical column, made of discs of zinc and gilt paper, is a variety of the galvanic arrangement; but, for want of acid or water, it produces, in a series of 1000, no higher degree of electricity than to vibrate a clapper between two bells; but, it proves that all surfaces having different degrees of conducting-heat, decompose the atmosphere, and become excited by a delicate and minute separation of its oxygen and hydrogen. This action lasts for years.

Hare's calorimotor consists of coils of zinc, 9 inches by 6, within coils of copper, 14 by 6, and a quarter inch apart, 80 in number, let into glass jars 2⅜ inches in diameter and 8 high, filled with dilute acid. Another, at the Royal Institution, consists of coils of copper and zinc, 60 feet long and 2 broad, in a tub of dilute acid.

Mullins and Daniell produce a voltaic current by placing a membrane between the plates, and separating the dilute sulphuric and nitric acids of the zinc from the sulphate of copper on the copper side. Also, by bringing the membrane into contact with the zinc, and using only the sulphate. This principle is now generally adopted.

Daniell and Mullins have applied a calf's bladder to the great battery at the Royal Institution, and produced permanent action. They also proved that the nearer the surfaces of the metals, the greater is the power. The best fluid they found to be 5 of sulphuric acid to 100 of water.

Dr. Philip divides the distinct vital powers into the muscular, the nervous, the sensorial, and the living blood. Three are peculiar to animals, but the nervous (in the brain and spinal cord) can be imitated and performed by voltaic electricity, and is, therefore, not a vital power. He further considers the body as two systems, one for maintenance, and the other for intercourse.

Metals may be considered as so intimate a union of oxygen and alkali, as to defy the power of galvanic action to separate them, for they appear to have been generated in veins by slow galvanic action, and, therefore, are not separable by the same agency.

Veins and lodes are filled with metallic substances and crystals, whenever the local rocks are mixed, and in local confusion. But, in this case (as in that of stalactites) the product is not only in cavities, but may arise in the very substance of the strata; and, hence, those metallic stones, or solid masses, as iron-stone, part earth, part metal, in which the metallic particles may be regarded as products of silent electrical restoration. In this view, definite proportions and different multiples of oxygen, hydrogen, and the aura of the Earths, may produce all the metals.

The theory of terrestrial currents of electricity, derived from the production of metallic crystals in lodes and veins, is unfounded; since these metallic products are generated *only* where mingled rocks are themselves sufficient, and there is absence of the effect where local causes do not exist.

Terrestrial electrical currents, says Fox, would act on saline substances in fissures in the magnetic east and west, and decompose them, carrying the metal or base to the negative side, and the acid towards the positive side. The general contents of veins would then depend on the rocks which they traverse, and he insists that it is so.

In an empty vein, or lode, the electric would be the air, and the walls the termina-

tions of the plate, which, if different rocks, or the same dry or moist, would re-act on the intermediate electric, and produce a commixture of the aura, which aura, combined and condensed, would, in countless ages, become crystals and ores. For this action and result, no incomprehensible terrestrial current would be necessary. The sulphurets would also act as electrics and vary the results.

Since all electricity consists of two elements, seeking equality of distribution in space, it is not easy to imagine that any currents pass round the Earth, such as the illustrators of the cause of magnetism would teach. All such currents require locality, starting points, and other essential circumstances in the mode of operation.

In 1790, Galvani accidentally discovered that the principle of animal action and electricity were the same, and step by step he and Volta arrived at the voltaic battery.

Iron is dissolved by nitric acid, though diluted with 480 or 960 times its volume of water, and when diluted iron cannot be protected either by itself, or by platinum, or gold wire. Some English writers who claimed Schoenbein's discovery, happened not to know this.

In exciting plates for voltaic electricity, a weak mixture of sulphuric acid and water within the membrane, wherein the zinc plate is contained, or a solution of salt in water or sal-ammoniac, will do as well. And a saturated solution of sulphate of copper to fill the box. The ivory trough usually connected, must have some mercury put into it, for the convenience of making the communication with the zinc, *i. e.* the north or positive side, and the copper or opposite side. After use, the plates should be removed, and washed and dried, to prevent spoiling.

MAGNETISM.

Magnetism is the directive power of an ore or preparation of iron towards the polar regions, which varies consecutively, but regularly, at the same place, both in dip and polar declination. The two similar ends of needles increase each others distance, and the two dissimilar ends cause approach, just as in positive and negative electricity. The affection is created by the double current in the wires, which connect and restore the positive and negative sides of an electric or voltaic excitement, and the direction, with reference to the current, is that of the tangent of a circle round the wires. The end of a needle, as it is *above* or below the wires, is N. or S. It is therefore believed, that, as iron and steel are laminar or scaly in their structure, like the plates and cells of a voltaic arrangement, or the membranes of a torpedo, that the iron is charged by the lateral action of the current on the surrounding space just as in all electricity.

The directive power has been ascribed to currents of electricity passing round the Earth. But the word electricity is used in a false sense, for there is no electricity *per se*, and it is only action and re-action, disturbance, and double and opposite restoration. Further, this does not accord with variation, and cycles of variations. Rather, is it not a lever definite, poised with equal action and re-action from end to end, and therefore subject to the motions of the Earth; and are not its cycles those of the Earth's combined motion? In confirmation, we find no variation beyond the extreme declination of the Moon; and that the magnetic Poles are within the angle of the Equator and Ecliptic. Is not the magnetic Equator a mean of all the motions, and is not the dip an effect of the preponderating orbit motion? Nevertheless, Barlow imitated the phenomena by a globe with currents, and the funds of the Royal Institution have recently been applied to an analogous construction.

It is a condition of the theories, that, in artificial magnetism, the effect is as the surface, and just as in electrical conductors, a hollow magnet and a solid one of equal surface has equal power of lifting other iron, &c. Nor is it to be overlooked as a remarkable feature, that at the depth of only 20 or 30 feet, there is no variation, and that other variations cease even at less depths. We seem, therefore, obliged to refer something to the medium of space, and to its re-actions on a moving earth; and it seems to be rather a mathematical problem, than a chemical or experimental one.

Magnetism is a diminutive of electricity. If the cells of the galvanic arrangement afford no space for display, far less are the cells or laminæ of iron adapted to display. We therefore get no spark, &c. from a magnet, and only know of the existence of the force by the excitement of iron ore, or iron and steel in continuity. The sparks obtained are by the re-action on electrics, which give sparks by the reflex excitement of magnets. In fact, the laminated space is too short for the evolution of light.

Mr. T. S. Davies has elaborately investigated the History of the Compass, and he determines, beyond all question, that it was *used* by the Chinese, under the name of the *Tche-chy* (directing-stone) about 2604 years B. C. It passed from them through the Arabs, and was first used in Europe after the Crusades. The power of the loadstone to act on iron, not the polarity, was known to the Greeks.

Sanchoniatho ascribes to Chronus the invention of "Batulia, or *Stones*, that moved as having life;" Chronus lived about 2800 B. C.; and, if so, the discovery passed from Western Asia into China.

Œrsted, at Copenhagen, in 1813 discovered that a galvanic wire, forming the circuit of the Poles, exerts an influence on the magnetic needle inversely as the distance; and that if a circle be described round the wire, through the centre of a needle, it will become a *tangent* to the circle, or stand at right angles to a radius of the circle. When the wire was placed directly *over* the needle, that next the negative side of the battery,

towards which the positive current was flowing, turned to the west; but, when placed *under* the direction of the Poles, the needle was reversed, and turned to the east. Again, if the wire was placed at right angles, the nearest pole was depressed or raised, as the current in the wire proved east or west. And, if the wire is vertical, the needle deviates east or west, according to the current; the whole proving that the wire is like another magnet, which acts on the same pole, and re-acts on the contrary pole, and that electricity and magnetism have the same cause.

The experiments of Ampere, Arago, Davy, Faraday, &c. made since 1815, have proved that a current of galvanic action changes the position of the magnetic needle from north and south, to east and west, or, in other words, that the force of a galvanic current, and that in the magnet, are *tangential* to each other, and at right angles. This was explained on the principle, that as each pole had its own determined electricity, so a current of common electrical action would accord with neither, and the consequent re-action would place the two poles at a right angle to the current. Polarity is, therefore, inferred by them to be the effect of an electric current following the heat of the Sun, and directing the natural arrangement of the loadstone into a direction at right angles, or towards the poles.—*Roget.*

M. Ampere, Vanden Bos, and De la Rive, followed the facts of Œrsted, so as by delicate arrangements to connect the magnetism of the Earth with the galvanic current, and they opened the road to the late successful course of experiments of Dr. Faraday, at the Royal Institution.

All doubts of the electrical character of the magnet or loadstone have, however, in 1831—2, been removed by Dr. Faraday, who, in a series of very curious experiments, has succeeded in identifying magnetism and galvanism, by directing galvanic currents at right angles to the direction of powerful magnets; and has produced the galvanic currents from terrestrial magnetism, and thus proved that the same causes or elementary disturbances produce the directive character of both.

The conducting-wire of the galvanic poles is impelled to move in the tangent of a circle, whose centre is in the axis of the magnet prolonged; and whose radius is a mean proportional of the distances of the centre from the two poles.—*Ampere.*

M. Ampere has made electro-dynamic cylinders, which, in force and action, exactly represent magnets, and may be substituted in place of them. That end in which a current of positive electricity is moving, in a direction like the bands of a watch, is the south pole of a magnet, and the other end has northern polarity.

From the nature of the hemispherical induction, magnetic needles are similarly electrified in their whole length, positive and negative, or the contrary. Hence, if broken, every part has its own north and south pole. The excitement, too seems to be accelerated like the cells of a *voltaic* trough, from end to end.

A needle on one side of the wire is exposed to the negative hemisphere, and turned one way; and a needle on the other side is exposed to the positive hemisphere, and then is turned contrarywise. So the wire above and below presents an action compounded of both, and the result is oblique but congenial. There is a sphere of action, and the needle is a constant tangent of all the radii.

Owing to the tangential action of a connecting wire on a magnet, and of a magnet on a wire, Faraday, Barlow, Watkins, and Griffiths, have made a variety of ingenious toys to evince this action and re-action.

Scoresby announces that a magnet indicates the precise thickness of a rock, by the intensity of its action on a magnetic needle.

The magnetic needle, acted upon by the wire of a current, places itself in a direction intermediate to the magnetic meridian, and to the tangent to a circle round the electric current as it is more or less intense.

In electro-magnetism, a magnetised needle always places itself at right angles, or tangent-wise, to a galvanised wire, so that the poles of each are at right angles to those of the other. The tangent of the needle's deviation, according to angular distance, is the measure of the galvanic power.

To produce *magnetic* electricity, pass a long helix of *copper* round a pasteboard cylinder, in which insert a bar of soft *iron* then, with the two ends, join the poles of a powerful horse-shoe magnet. The effect may also be produced on the galvanometer by passing a copper plate round the bar instead of the helix. Iron and copper are essential to the effect of magneto-electric induction, though copper helixes and wires indicate a current.—*Faraday.*

The magnetising effect of the current between the poles results from the commencement of the current, and is not produced when the current is established. It appears as though one of two principles was foremost.

Iron filings attach themselves in masses to the connecting-wire of the poles, but they fall off on breaking contact.

Needles placed transversely are permanently magnetized; those *under* the wire, with the positive end to the right, have north poles to the operator, and those above the wire, south poles.

A Leyden phial or battery does the same.

A copper helix improves the force, and it may receive the bar or be wound round it. A horse-shoe magnet has thus been made to raise from 150 lbs. to above 2000 lbs.

A current round a needle, viewed endwise, in the direction of the bands of a watch, or a working-screw, would make the needle into such a magnet as the dipping-needle. A returned current would produce contrary results.—*Faraday.*

A galvanometer is a magnetic needle placed between the two directing-wires of

galvanic arrangement, and the deflection measures the strength.

A cylinder of soft iron, 18 inches long, and one diameter, bent horse-shoe form, galvanised in a helix of copper, will lift, for a very short time, from 50 to 150 lbs.

The poles of the magnet, used in generating electricity at right angles, govern it as *positive* and *negative*, and clearly prove the identity of the two.

Knight's compound magnet, belonging to the Royal Society, consists of 450 bar magnets, 15 inches long, one wide, and half thick. A soft cylinder put across the poles requires a force of separation of nearly 100 lbs. Some German magnets are 2000 lbs.

Lifting power arises from the iron lifted becoming part of the magnet.

The limbs of a frog are affected by a magnet which lifts 30 lbs.—*Faraday*.

It is usual to consider the end of a magnet, which points towards the north of the Earth, as the south pole of the magnet itself; since it is inferred that the end points northward, because its magnetism is of a different kind.

The magnetic force, like others, is expressed by the square of number of oscillations of a needle in the same time. It increases from the Equator to the Poles, being double in Baffin's Bay, and it varies in the same places annually, and even daily.

Fox's magnetic balance determines less than the 10-thousandth of a grain.

M. Arago found, that if a plate of copper and a magnet be suspended in parallel planes, and the plate be rotated, the magnet follows it; or, if the magnet rotates, the plates rotate with it. But Dr. Faraday shews that the cause is electrical, and, moreover, an example of magnetic electricity, and he used it as means of obtaining positive and negative electricity at pleasure.

The rotation of plates is one case of electrical excitement, in which we have a generation of the electrical intensity, somewhat similar to that by the voltaic arrangement.

In sympathetic revolving plates, the sympathy is destroyed by interposing plates of copper, silver, and zinc, and a thick plate of lead.

Faraday has conclusively demonstrated, that in every case where a magnetic current is created, a momentary electric current is induced, at right angles, to the magnetic current; and he proves it, either by mechanically causing a magnetic bar to traverse the axis of a helix of copper-wire of considerable length,—or, by causing a piece of soft iron, placed in the axis of such a helix, to connect the poles of a horse shoe magnet, and thus acquire polarity.

Barlow determined the relative powers of iron as under:—

Malleable iron	100
Soft cast steel	74
Soft blist. steel	67
Soft sheer steel	66
Hard steel	53
Cast-iron and steel	48

More in each when hot than cold.

The force of magnets diminishes as the inverse distance. They have the force of contact at the distance of the 2000th of an inch. At a quarter of an inch a 1200th.

At a white heat it has no intensity, but at red, some, but contrary to cold, and then lower when returned to its cold state.

Soft iron loses its magnetic power, when separated from a magnet, but steel retains it, and forms magnets equal to loadstone.

Magnetic action passes through all substances that have been tried, and even through iron, by rendering it magnetic.

A natural magnet is a grey ore of iron, in octahedron crystals, composed of from 75 to 85 of iron, and 25 to 15 of oxygen. It acquires its magnetic power after exposure to the air, and then lifts from 40 to 50 times its own weight, but different parts have various power, and two opposite points have most power.

Barlow determined that magnetic power of an iron sphere is entirely on the surface, whatever be the thickness of the metal, and if a shell is above the 30th of an inch thick, it is equal to a solid ball. A hollow sphere of 4 lbs. acts as powerfully as a ball of 200 lbs.; and hence, in steel-making, iron bars are stewed in charcoal at a white heat for many days; and after this the iron forms, as steel, permanent magnets. It may hence be supposed, that carbon confers that uniformity on the laminæ, which is necessary to their perfect action, when excited into magnets. On the contrary, in soft iron we may assume that the laminæ are less perfect, like broken plates in a trough, and lose the excitement as soon as the action ceases.

A metal will display magnetism, if it contains but the 130-thousandth of iron.

Faraday thinks all metals are magnetic at a certain low temperature. Iron, he says, is non-magnetic up to an orange heat, and nickel at 630°. A magnet loses its own power at the boiling point of almond oil, and then loses the power of soft iron at an orange heat. Loadstone preserves its power up to a dull ignition.

Pouillet says, that cobalt retains its power up to a bright white heat, chrome up to a dark blood heat, nickel to the melting point of zinc, and manganese up to 20 or 25 below zero. Differences which he ascribes to the proximity of, and approach to, the atoms of the bodies.

Needles of nickel have polarity, and produce half the oscillations of steel ones, *i. e.* 10 in 87 seconds to 10 in 45 seconds.

Hammered brass affects the magnetic needle, and cobalt, zinc, copper, bismuth, and their ores, do the same.

Antimony, combined with iron, destroys its magnetic properties; 4 antimony to 1 of iron is non-magnetic. So arsenic, nickel, copper and nickel, are non-magnetic.

Carbon, sulphur, and phosphorus in excess destroy the magnetism of iron, but have no effect to a certain point.

Basalt affects the needle from its quantity of iron. There are other irregularities, temporary and local.

Iron filings are separated from those of brass and copper, by magnets.

Lebaillif determines that all bodies have some influence on the needle, and antimony and bismuth a repelling force.

Harris considers steel-wire the best for compass needles.

Cast-iron is said, by Cunningham, to retain the magnetic power as powerfully as steel; others prefer steel at the blue or spring temper, or, with Scoresby, ladies' busks.

A lifting power of 300 or 500 lbs. is conferred by galvanic plates on the dimensions of a pint. The power is nearly as the distance at which the magnet acts on needles.

When a piece of unmagnetized iron is brought near the pole of a magnet, it is magnetized, and the part next the pole becomes a contrary pole. But, if contact is made, then the two become as one magnet, and the poles are extended from end to end as one. The power exerted is the lifting power, or that of the first magnet.

If an electro-magnet is overloaded, or too far extended, it loses power; but the power is restored by breaking contact, and renewing it again, or, it is not disturbed, if paper be glued on the poles. If the excitement be divided between several parts, the force is nearly in the inverse ratio of the number.

As iron re-acts on a magnet, the power is increased by annexing a bar of iron to the poles, and slowly adding more iron than it would at first carry.

Conducting-wires, to give them force through the length of a magnet, are coiled like corkscrews, and then a magnet being placed within the coils, is raised, or lifted into the centre of the coils, and upheld by the electricity. The helix itself becomes a magnet, while the electrical restoration is passing through it.

The coil or helix of wire, insulated by silk, and wound round a bar of soft iron, causes the galvanic currents from copper, and from zinc plates in dilute acid, to pass both ways through it at right angles to the axis of the bar of iron; and then this direction of the current confers polarity on the bar, and, for the time, gives it all the properties of the loadstone. The horse-shoe form renders it more powerful and convenient by the juxta-position of the contrary poles; the bar then renders any iron connected with it equally magnetic, and, by this extension of its power, will affect, attach, and bear up vast weights. One in America, of 27 lbs. weight, thus identifies itself with a ton of annexed iron; and others, which bear up several hundred weight, are common.

The separation of the two ends of the helix or coil, from the zinc and copper plates, instantly destroys the effect. And if the direction of the current or copper and zinc sides be changed, the poles are instantly reversed N. and S. to S. and N.

If we place a bar of iron near an electrical current, we get a feeble or partial magnetism; but if we resort to the helix or the wire-coils, we increase the effect *all round.* Then, to get electricity from magnetic action, we use similar coils on the principle of re-action, and get an electrical spark.

Gauss finally determines magnetic force to be as the inverse square of the distance. In Sept. 1832, he found the horizontal intensity at Gottingen, 1·7821; and in relation to gravity, 0·0039131. Then this, by secant of the dip, (68° 22′ 52″) is the intensity of terrestrial magnetism. His bars weigh 25 lbs. each.

Barlow's magnetic compensations consist of two parallel iron plates, 12 or 13 inches, in diameter, placed between the compass and the body of the ship. It then doubles the error from the local action of the iron in the ship; and, hence, the true direction is determined. Ships' iron varies the direction from 4° to 14°.

Mullins prefers magnets at arcs of 60° to the horse-shoe form.

O'Slaughnessy found, that, for magnetic force, the intensity of many small plates is superior to quantity from two large plates.

Twisted magnetic wire loses its power by being twisted in the contrary direction.

Tomlinson asserts, that fine iron-wire, in an empty glass, turns, on the glass being vibrated with the finger, into the magnetic meridian.

A straw on a cup of water points the same way while carried round the room.

Tangentially, magnetism and electricity, or voltaism, are reciprocal of each other. Electrical action diffused from an excited point, extends to an obstructor, and then is diffused in a tangential plane on the side of the electric, next the conducting surface.

As an effect of form, there is a pole at each end of a wire or magnet: but as every two points becomes two poles when severed, so the action is a totality from each end to each end. It is scarcely safe to adopt even the hypothesis of a current, for, if so, it applies alike to electrical and magnetic action, and in the last does not appear, except as to iron.

As the steel or iron is affected lengthways, so the double action produces a neutral centre, while the strength of magnets will often depend on the direction of the laminæ, as lengthways, or oblique.

In a steel wire, 24 inches long, the poles are 1·5 inch from its extremity.

Every particle of a magnet in every line of direction, is like the length positive and negative; hence, as all these lines of action are on each side, and all round, directed in surplus to the centre of the magnetized mass, so every part thus concurs to generate the centre; and this being thus fixed, by the general action of the two ends of the length, are determined, and their distinct and contrary force cannot be restored, without destroying the magnetism of every part.

The magnet, lengthwise, in one state at one end, and the opposite at the other end, exactly resembles every case of electrical excitement, positive on one side or surface, and negative on the other. Then, if we consider the electrified sides, as joined by a line, that line would exactly accord with the axis of a magnet, and be at each end in an

opposite state. Nevertheless, in the magnet the effect is permanent; but, in the electrified line, the two ends may be combined.

It is fatal to all projects about power from magnets, that soft steel only indicates power to actual contact, when it also loses it; so that there is no power of solicitation; and, hence, the mechanical transfer of motion has proved impracticable!

Iron bars, rendered magnetic, affect other iron at an extremely small distance. Two excited iron bars act on their contrary poles farther; but steel bars, which maintain a permanent excitement, act at greater distance. That is, they render iron, brought near them, of the contrary pole, (by acting through the air) as in the case of needles and iron-filings. The whole is an effort of the two lengths, even to the two ends or poles to unite; and whether lengthened by additions, or shortened by severation, the same effect between the ends, or from end to end, continues.

A long bar of iron produces a succession of poles, N. and S., N. and S.

A magnet will induce the contrary magnetism in the middle of a bar, and make both the ends either N. or S.; so, if a bar be placed between two opposite poles, each end will be contrary, and the same, and the middle be a pole to each. The centre of discs are thus made a contrary pole to the circumference all round.

The approximating force of dissimilar poles, is greater than the repulsive force of similar ones; one increasing the other, and diminishing the other.

Bars of 30 times their diameter have but one magnetic centre, and that in the middle. When of greater length, there are 3 poles, 1 in the middle, and 1 on each side, where, and at the ends, it takes up steel-filings, and position varies with the temper.

Iron acts on the magnet, as well as the magnet on iron, as appears by fixing them alternately. Iron, connected with a magnet, acts in continuity, like the magnet; and, iron approximated, reduces the power of the magnet.

Figures traced on steel by the pole of a magnet, are exhibited by siftings of filings.

The Aurora Borealis appears, by repeated observations, to affect the variation of the needle from 1° to 5°. It also much affects the dipping-needle, and the effects are simultaneous at distances of 1500 miles in longitude. Near the magnetic pole, the Aurora affects the needle 8°, unless it is a very elevated and diffused Aurora.

The successive steps of the blow-pipe, the machine electricity, the voltaic combination, magnetic powers of iron, seem to prove, beyond doubt, that in each we get the same elements more and more concentrated, while the mode of exhibition depends on the excitement, and on the structure or re-action of the bodies affected.

Barlow's theory, which refers the whole to electric currents, is the most rational; but he is at a loss for a generator of his electricity; and Hanstein makes a good approximation, though bewildered about the Sun and planets!

The most absurd theories are those of Halley, and his internal magnetic globes; and that of Brewster, about his poles of maximum cold!

We infer much from the creation of magnetism; and we may infer something from its destruction. Thus, great heat destroys it, apparently, from its effect on the laminæ of the iron; so, also, violent blows destroy it; and we are to bear in mind, that heat and blows are only different modes by which great atomic motion is excited.

Snow Harris reduces inductive power to distance, when the intensities are equal; but the force from the centre to the pole, he determined to be as the square.

M. Ampere explains magnetism on the gratuitous supposition, that electrical currents are constantly passing round them at right angles to their axes; and, on this supposition, he founds an elaborate theory.

Œrsted, Barlow, and Faraday, have enabled us to reason correctly about magnetism. The first, in proving that iron becomes a magnet, by the projectile action of a voltaic current; the second, that the action is exterior to the iron, by proving that magnetic force depends on the mere surface, just as in superficial electric conductors; and the third, by generating from the re-action of the magnet an electric spark, and evolving from the Earth both magnetism and electricity, so as to produce either from the other.

The figures formed by a magnet on a steel plate, and formed by the dust of iron-filings, last for mouths, and the plate must be heated to the melting-point of tin to de-magnetize it. A magnet even draws the figures on the steel through a card or other substance.

Barlow's revolving iron sphere produced all the effects on wires conducting the galvanic intensity. If, as may be assumed, the rotation of the earth produces similar longitudinal currents, there can be no difficulty in referring polar direction to such currents as their tangent.

No man who looks at the isochinal magnetic lines of the two hemispheres, can doubt that they are necessary resultants of simultaneous motions, adverse and oblique, and are displays of the action of the moving mass, on the medium in which it moves.

When a bar of iron is in the magnetic equator, it loses all power on a needle.

Horary variations are universal, and coincide at distances of 100 miles.

A bar of hard iron or steel becomes a magnet, if held in the direction of the dip, or magnetic axis, on receiving a vibration of its atoms from a few blows of a hammer, or heat followed by cold or electricity; and Hanstein asserts that every substance held in that direction is magnetic.

Kraffp discovered that the tangent of the dip, in any magnetic latitude, is equal to double the tangent of the latitude.

Barlow discovered that round every globe and mass of iron there is a circle, inclined to the horison at the complement of the dip, and

that the plane of this circle displays no intensity on a needle whose centre is in that plane. Then, regarding this circle as a magnetic equator, the tangent of the variation will be as the product of the sine of double the latitude, and the cosine of the longitude; and, also, that the tangents of variation are as the cubes of the diameters of the shells.

Terrestrial magnetism also produces electric currents, by connecting a helix, placed in the magnetic meridian, with a cylinder of soft iron, which becomes a temporary magnet, owing to the electricity passing through the helix. A copper plate, in consequence, revolved at right angles to the dip, ejects abundant electricity, and the current is outward or inward as the rotation is to the right or left. It has also the heating power of voltaic electricity, and has been used to decompose water.

A copper wire bent as a rectangle, and a current of electricity passed through it, ranges itself at right angles to the magnetic meridian; and a similar rectangle, on an horizontal axis, ranges itself on the plane of the dip, both by the action of terrestrial magnetism.

Faraday observes, that such is the facility with which the terrestrial magnetism evolves electricity, that scarcely any pieces of metal can be moved without its developement.

The least intensity of the needle is at half-past 10 in the morning, and then it increases till half-past 7 in the evening, and becomes 1·0024 of the minimum taken as 1, but varying with the season. Even the same needle, at the same place and temp., varies from 1136″ to 1139″·5 for 200 vibrations.

At 10 in the morning and evening, the needle is in a mean position. In the morning it moves W., and in the evening E.

At 28 feet depth in the ground, the variation is but 1·75° at the mean of 6 parts of Europe. At 55 feet, but the 15th of a degree; and, at 80 feet, but the hundredth of a degree. In higher latitudes, the mean is at less depth.—*Quetelet.*

At 4 feet depth, the diurnal variations become insensible.

At depths in the earth, of 3 and 6 feet, the fluctuations follow those of the surface; but at 12 feet, there is a sensible abatement; while at 24 feet, the variations are slight, and nearly contrary to those at the surface.

Every change of 12′ in the dip varies the horizontal force ·01, when the dip is about 70°.

The declination was observed to be about 5° to the East, in 1350, and Columbus noticed the variation in *situ.*

In 1580, at 11½° at Paris, and at Limehouse 11° 19′.

Norman, in 1576, discovered the dip, then 71° 50′. Gilbert and Bond published, at large, on the subject in 1600 and 1650. Hooke proved the connection of the magnetic meridian with the formation of artificial magnets in 1684. In 1663, Halley published some idle theories, which mystified the schools for a century. But, in a voyage, he made a chart of variations.

Graham, in 1722, discovered the daily variation of 35′ to 55′ increase in the morning, and decrease in the evening; and Canton shewed, that it was least from Nov. to Feb., and greatest from May to Sept.

Coulomb proved that the force decreased, like heat, inversely, as the square of the distance; also, that the effect from the pole towards the centre of a 27-inch magnet, was as 165 at the poles, 90 at 1 inch, 48 at 2, 23 at 3 inches, and only 6 at 5 inches of a 13½. He found the same law in electricity, and that all bodies are affected by magnetic action; but he ascribed it to the iron which they contained.

Barlow's rule for the variation at London, taking 1660 as 0, and the difference 4·14 in 10 years, is to take the co-tangent of the polar angle of the magnetic pole with London, add log 1 65642, and find the angle, of which the sum is the tangent. Then to the same co-tangent add log. 0 03987, and find the arc, of which the sum is the tangent. Then the first, deducted from the last, is the variation. This agrees very nearly, and may be extended to all places.

From Jan. to April, the variation increases; and from April to July it diminishes. In October it is the same as in May, that is, for 3 months it recedes easterly, and for 9 months westerly. The maxima are in June and August, and the minima in Dec. and July.

There are daily variations, which, at a mean, are about 11 minutes; greater when the Earth is in aphelion, and least in perihelion.

In 1658, the line of no variation passed at London, but it is now at New York.

In N. lat. 70° 5′ 11″, and W. lon. 96° 46′ 55″, Ross found that the needle dipt 89° 59′. Another pole is believed to exist in 65° N. lat. and 102° E. lon.

The magnetic equator is where the dipping-needle is horizontal. It has about 12° of inclination, and crosses the equator at 2 points, one in the Atlantic, and the other in the Pacific. The dip has decreased about 3 minutes per annum, and the equator is said to move from E. to W.

Wilcke and Hanstein establish the fact of 2 southern magnetic poles, a strong one near Van Diemen's Land, 136° 15′ E. 69° 27′ S., and a weak one near Terra del Fuego, 123° 56′ W. and 77° 17′ S. The northern hemisphere has, also, a strong one in Baffin's Bay, 100° 2′ W. and 70° 17′ N., and a weaker one in Siberia, 101° 29′ E. and 85° 43′ N. These double poles, of course, indicate 2 magnetic axes, and the poles are points of convergences. Observations in 1586, 1594, 1642, 1670, 1725, and 1805, shew, that these points are not stationery, for early observations shew that the northern points were then more westward, and the southern more eastward. The strong poles, too, recede, from the terrestrial poles, and the weak ones approach them.

The two north magnetic poles revolve from W. to E. in different periods, according to Hanstein, one in 1740 years, and the other in 860 years. The two southern, one

in 4609 years, and the other in 1304 years. He places the strongest N. pole in 1840 in 85° 15' W. lon. and 69° 22' N. lat., and the weakest in 148° 18' E. lon. and 85° N. lat. The strongest S. P. in 131° 1' E. lon. and 68° 37' S. lat. and the other in 140° 31' W. lon. and 78° 41' W. lon. and 78° 54' S. lat.

The number divisible by the four periods is very nearly that of the precession of the equinoxes, and in their lowest terms they are 2, 3, 4, and 10.

Hanstein considers the two strongest poles as terminations of one magnetic axis, and the two weakest of the other axis.

In 1813, observation in Hudson's Bay gave 67° 10' for the lat. and 92° 24', differing slightly from Hanstein. And different observations prove the motion to be 11' 4" ·23, being a revolution in 1890 years, or 50 more than Hanstein. Observation, too, assigns to 4' 67" for the annual motion of the strongest south pole, or 4605 years. The weakest or Siberian N. P. moves 35' 128" per annum, and the weakest S. 16' 57".

Barlow tried and calculated the place of the North M. Pole by the actual dip and variation at different places, but the results did not agree, and he concluded that every place makes its own pole in the Arctic regions.

The dip at Trinidad is but 10°, and var. 5, but at Regent's Inlet, the dip is 88° 26', and the var. 118° 16' W. if measurable. At Melville Island, the dip was 88° 43', and the var. (27) 127° 46' E.

The mean inclination of the magnetic equator to the terrestrial, is 12°, and its major intersections are in 113° 14' West long., and 66° 46' East long. But there is an inflexion in the Pacific, and beyond the Western point it recrosses the terrestrial equator, about 1½ degrees, and returns again. In the Arabian sea, in 62° E., its most N. lat. is 12°, and it keeps N. to 174 E. or 187 E. It passes N. of Comorin, and in Siam is 8° N., and at the Philippines is again 9° N. It then crosses the Carolines.

At the magnetic equator in Peru there is no dip, and the intensity is there taken as 1. At Lima, the dip is 9° 59' S., and the intensity 1·0773. At Port du Sud, the intensity is 1·6133 the greatest South, and at Port du Nor the dip is 75° 50', and intensity 1·5773. In N. lat. at Quito, the dip is 13° 22', and intensity 1·0675. Both then increase to the North Polar Sea. At Mexico, dip 42° 10', intensity 1·3155. At Rome, 61° 57', intensity 1·2642. At Pekin, 54° 52'. At Mount Cenis, 66° 42', intensity 1·3441. Paris, 69° 12', intensity 1·3482. Gottingen, 68° 23', intensity 1·3485. London, 69° 57', intensity 1·3742. Petersburg, 71° 7'. Tobolsk, 70° 56'. Bergen, 74° 3', intensity 1·422. Edinburgh, 71° 37'. Davis' Straits, 83° 8', intensity 1·6365. Montreal, 87° 45' N. Magnetic pole, lat. 70° 5' 17", long. 96° 46' W. Dip, 89° 59', or perpendicular.

The Dip has decreased at Paris from 75°, in 1671, to 67° 41' in 1834, and in London from 74° 42', in 1720, to 69° 17' 3" in 1833. At Bruxelles, it is 68° 32'; at Gottingen, 68° 13'; and, at Berlin, 68° 16'.

Twice the co-tangent of the magnetic latitude, ought to be equal to the tangent of the dip every where. The annual diminution, owing to change in the position of the poles, is about 3' 5".

The sooner a needle ceases to oscillate, the greater the force of the terrestrial magnetism, that is, it is as the square of the number of oscillations in the same time. At London, 300 oscillations are performed in 775 seconds; at Paris, in 753; and at Edinburgh, in 820; at Oxford, 780; at Berlin, 760; and at Bergen, 850. The intensity increases from the equator, the poles with the dip. Taking 0 dip as 1, when 45° the intensity is 1·2, and when 81°, is 1·6.

In this century, the VARIATION was at:

	°	'	
Christiana	20	3	
Copenhagen	18	0	
Fredericsborg	18	50	
Kullens	21	0	W.
Awatscha Bay	5	39	E.
Catharinenburg	5	27	—
Carchow	5	17	W.
Irkutsk	0	32	E.
Nizni-Udinsk	2	40	—
Petersburgh	7	27	W.
Petropaulowska	5	20	E.
Berlin	17	40	
Dantzic	13	48	W
Leipsic	17	45	—
Tankermund	19	0	
Bushey-heath	24	35	W.
Hyderabad ..	1° 16'	39"	E.
Ascension	15	40	W.
Madeira	20	21	
Teneriffe	16	1	
St. Catharine's	7	51	E.
Abo	11	20	W.
Tornio	12	7	—
Uleaburg	9	32	—
Archangel	2	7	E.
Brest	25	7	W.
Hammerfest	11	26	—
Moscow	5	24	—
Benthem	19	41	—
Wittmund	20	46	—
Paris 1800	22	12	—
" 1816	22	25	—
" 1819	22	29	—
" 1829	22	12	—
Edinburgh 1808	27	32	—
" 1809	27	35	—
" 1812	28	8	—
" 1823	27	48	—
Leith, 1823	27	0	—
Falmouth	25	30	—
London, 1806	24	9	—
" 1812	24	17	—
" 1815	24	47	—
" 1816	24	18	—
" 1823	24	10	—
" 1831	24	0	—
Bruxelles	22	7	—
Port Jackson	8	56	E.
Manilla	0	17	—
Amboyna	0	28	—
Gallipagos	8	20	—
Otaheite	6	40	—
New Zealand	13	21	—

	°	′	
Paramatta	0	50	—
Pekin	1°	42′ 57″	W.
Wardoe	5	57	—
Udinks	2	40	E.
Embden	20	42	W.
Cherbourg	26	47	—
Toulon	19	10	—
Ushant	26	45	—
Corunna	20	47	—
Stromness	27	50	—
Leghorn	19	20	—
Minorca	19	30	—
Palermo	18	30	—
Corfu	14	31	—
Dardanelles	12	32	—
Trebisonde	8	14	—
Comorin	2	9	E.
Trincomale	1	9	—
Batavia	0	17	—
Macoa	1	12	—
Madras	3	0	—
Prince's Island	27	0	W.
Achen	2	25	E.
Alexandria	10	58	W.
Funchal	25	58	—
Porto Praya	13	30	—
Mauritius	13	40	—
Cape Town	27	30	—
Goree	19	35	—
St. Helena	17	30	—
Prince Wales Island	22	30	—
Tripoli	16	35	—
St. Thomas's	22	48	—
Arica	10	25	E.
St. Blas	8	40	—
Barbadoes	4	30	—
Curaçoa	2	1	—
Havanna	7	0	—
Coquembo	14	0	—
Calao	9	30	—
Fort Erie	1	42	—
Bogota	7	30	—
Guayra	4	53	—
Port Royal	4	10	—
Lima	9	50	—
Mexico	6	30	—
Niagara	1	27	—
Panama	8	0	—
Rio Janeiro	3	21	—
Vera Cruz	10	37	—
Valparaiso	14	43	—
Fort York	6	0	—

In 1576, it was at London, 11° 15′ East. In 1622, but 6° 12′. From 1657 to 1662, due-north. In 1666, 0° 34′ West. In 1672, 2° 30′. In 1700, 9° 40′ West. In 1760, 19° 30′. In 1800, 24° 36′. In 1816, 24° 8′. In 1823, 24° 10′, and in 1831, 24°, returning towards 0.

At Paris, in 1667, it was 0. In 1700, 7° 40′ West. In 1750, 17° 15′. In 1800, 22° 12′. In 1814, 22° 54′, and in 1829, 22° 12′ West.

At the Cape, in 1605, it was 0° 30′ East, and in 1609, 0° 12′ West. In 1791, it was 25° 40′ West, and in 1804, but 25° 4′ West, returning.

Hanstein ascribes these changes to the different periods of revolution of the poles, the weak and strong interfering, and shews that the times accord with his periods of their revolution.

Hanstein, at the public expense, made a journey in Siberia, and there discovered the second North Magnetic Pole. The first pole gave a line of no variation through Petersburgh, Moscow, and Kasan; and this second no variation at Kiachta and Nizni-Oudinsk. The first is taken to be in 80° West and 60° North, and this second in 100° E. and 60° N. *i. e.* 180° distant.

Lines of equal intensity, and equal dip, are not parallel; and the intensity is subject to monthly and daily changes, and is a maximum in perihelion, and a minimum in aphelion. The annual variation is 0·0359. Lines of equal intensity are isodynamical.

The intensity is not lessened by heighth or depth. It is equal in a balloon at 13,000 feet, and at 1660 feet in a mine; and while at Geneva, it is 1·0805; it is 1·0966 and 1·0997 at the top of the Alps.

Professor Lloyd, in 1835, made a luminous magnetical survey of Ireland. He determined the mean dip at Dublin, for 3 years, to be 71° 3′, and the same, in an oblique line, drawn from 51° lat. from the right hand, to 51° on the left, passing near Killarney to the North 71° 8′, and Fermoy to the South 70° 43′. Another parallel to the South-East, gave Cork 70° 41′; Youghall 70° 39′, and Waterford 70° 49′. Another, North-West, gave 71° 30′ dip, and passed by Galway 71° 31′, and near Armagh 71° 37′, each North of it. The third, 72° dip, passed near Achill Ferry 72° 5′. Balhana 72° 9′. Strabane 71° 55′, and Coleraine 71° 22′.

The lines of horizontal intensity were less oblique to the parallels of lat., and that for Dublin 0·94 to London 1, passed by Limerick and Ballybunan with 94, and another at 0·96 passed over Waterford, Youghall, and Cork. Another set of parallels, more perpendicular, from 5° to 10° of long., for the total intensity of dip and horizon, correspond to 1·02, and passed by Dublin, Rathdrum, and Waterford. A second, 54 miles West, gave 1·025 of intensity, and passed near Limerick and Armagh; and a third at 1·03 passes over Carn, Enniskillen, Galway, Dingle, and Valentia. All agreeing with observations, and proving that the resulting cycles of magnetic action are as regular as any in nature.

O'Slaugnessy, in his valuable experiments at Calcutta, found that the greatest forces, whatever the weight of the bar, was attained by Wollaston's tin-plate 4-inch troughs with double coppers, or by Daniell's cans and zinc cylinders, with membrane and solution of sulphate of copper, and dilute sulphuric acid. Wollaston's double-plate, 4-in. square, gave but half the force, and other constructions far less. One of Wollaston's plates gave 13 lbs.; 10 gave 38 lbs.; and 20, 47 lbs.

Chemical batteries are, where batteries are ranged end to end, as one. Magnetic are placed side by side, and the terminal copper and zinc cells connected. In the latter, the force is as the number of batteries,

The connection of magnetism with electricity deprives it of all its conjuring properties; and its powers, miscalled attraction and repulsion, are now reduced to the well-understood action of electrified bodies.

The observed magnetic pole, and the verticity of the magnetic meridians, do not coincide.

An electric restoration, made through a poised conductor, or wire, places it at right angles to the magnetic meridian. If a needle be suspended *over* it, it will turn into the magnetic meridian: and, if *under it*, it will turn to the magnetic meridian; but its ends, as to the former, will be *reversed*.

Then, if the restoration, as to the electric poles, is *reversed* through the poised conductor, the two ends of the needle will also be reversed, as to N. and S.

Ampere has, in consequence, inferred, that the direction of the needle arises from terrestrial currents, or electrical restorations, in which the positive electricity moves from East to West, like the first restoration through the above conductor, the needle being over the earth. But in this, and all cases, we must not forget that while there may be one current from East to West, there must be an equal one from West to East. There is no electricity, *per se*, and all its phenomena are a restoration.

At the magnetic observatory at Gottingen, the declination varies daily, being 18° 37′ 40″·7 at 8 in the morning in June, 1839, and at 1 o'clock, 10 or 11 minutes more. It varies, too, about a minute in a month at the same hours, and the same changes take place in other distant towns.

Loadstone loses its polarity just before the heat becomes visible. At dull ignition it resembled soft iron.—*Farady*.

METEOROLOGY, & ATMOSPHERIC PHENOMENA.

If a globe of mixed materials were put into two motions, like those of the Earth, the first effect would be great confusion of the materials. If the motions were continued for a week, a month, or a year, the disorder would become regular, and assume the appearance of order. There would be subordination even in the disorder, and succession of causes would produce succession in effects. The materials, and the motions, would, in a few years, generate nearly all the varieties of gases, fluids, and solids, which we witness in the atmosphere and on the surface Thousands of years would work other changes, and new combinations It is this order and succession, and all the accompanying phenomena of air, winds, water, heat, cold, &c. consequent on the two motions, which constitute what we call METEOROLOGY.

The two great principles in operation, at the present epoch of the Earth's history, are weight, in air, water, gas, earths, &c.; and heat, or expansive force, or atomic motion, derived from pressure or friction, and from the sun. The former would produce but an inert mass without the latter, and hence all our active phenomena are derived from the latter.

The atmosphere, in fact, consists of atoms, raised by heat and motion, and re-acted upon by the central force of weight. The two constitute its elasticity. This we measure by the *Barometer*, a tube which is a vacuum, up which mercury or any fluid is pressed by the elastic force of the incumbent air. The tube is then provided with a scale of inches and 10ths, and with vernier for an 100ths of an inch. This takes off the pressure on the vacuum side, and hence the force of ascent. Any other interception would also create a force towards the intercepting body; and this, by mistake, is called capillary attraction, &c. &c., just as the ascent in the barometrical tube, or in a pump vacuum, used to be called suction. The ascent in the barometer proves that the general pressure of the air is about 15 lbs. to the square inch, sufficient to prevent water, &c. from expanding into gas or steam, by its ordinary degree of heat.

The other principal instrument used by meteorologists, is the *Thermometer*, for determining variations in heat. It is founded on the principle that all bodies, and especially fluids, expand in bulk by heat. A fine tube and bulb is partly filled with mercury, or other fluid, and the expansion, in the thread of the fluid, shews, by a scale, the degrees of heat. There are different scales; that of Fahrenheit runs from zero, 32° below the freezing point, to 212°, the boiling point of water, when expansive force overcomes weight; and often much higher for great heats.

There is also the *Hydrometer*, for determining the moisture in the atmosphere, and the *Pluviometer*, for measuring the depth of rain. Besides some others of less general use, as the *Anemometer*, for the force of winds, the *Electrometer*, for the electrical condition, &c. &c.

Galileo discovered the weight of the atmosphere; Boyle its elastic character, and connection with sound; Priestley, Scheele, and Mayow, investigated its chemical composition.

Air consists of 79 azote, or nitrogen, and 21 of oxygen, or vital air in bulk. And, as their specific gravities are 1·093 and 0·978, so 100 parts in weight is 77·44 of azote, and 22·57 of oxygen. Some make it 22 to 78; others 22·9 and 77·1, and 20 to 80, or an even 1 to 4.

Air, with the barometer at 30 inches, and the thermometer at 55, is 833 times lighter than water. A cubic foot of it weighs 1·2 oz. avoirdupois, while the weight of a cubic foot of water is 1000 oz.; and a cubic foot of quicksilver is 13,600 oz.

Air expands from ·00209 at 1° of heat, to 1 at 32°, 1·0476 at 54°, and 1·378 or 1·4 at 180°. All gases expand in like proportion, or a 480th for every degree. Thus, a bulk of 1000, at 32°, becomes 1152 at 100°, 1376 at 212°, and 2797 at 1000°.

The weight of a cubic inch of air, at 32°, is 0·327958 grain, and the expansion, from

32° to 212°, is 1·375. Therefore, the weigh of a cubic inch of vapour, at the saturation point, is 0·024 grain nearly.

When one volume of oxygen and four of nitrogen are mixed, it makes five volumes, and has the properties of atmospheric air. These, and all gases, mix, if placed in connected vessels.

The real density of the air, compared with the level of the earth, 1, is on

Puy-de-Dôme	583	fathoms high	0·9035
Mount Perdu	1185	- -	0·8106
Pic-du-Midi	1429	- -	0·7768
Etna -	1825	- -	0·7196
Chimborazo	3215	- -	0·5468
Gay Lussac	3816	- -	0·5

The atmosphere of the earth is reckoned to be a heterogeneous mixture of every kind of substance which composes the body of the earth; certainly of all kinds of effluvia and exhalation. The qualities of this mixture are extreme elasticity and tenacity, which seems to render it incapable of being separated except by intervenient matter; compressibility; extensibility, or capability of diffusion, believed to be illimitable; susceptibility to be disturbed by difference of temperature; and a promptitude of disposition to regain its equilibrium.

Air is a substance proceeding, and continually supplied, from the body in rotation, having been part thereof, and the more subtile and fine part ascends; and that an unremitted continuance of this process, by means of rotatory motion, diffuses a thin fluid, and forms the atmospheres by which the sun and the planets are surrounded.

The size of the volume of the gaseous atmosphere, which rotates with the earth, is an unsolved problem. The twilight proves that it contains vapours dense enough to reflect light as high as 44 or 45 miles. The rarefaction by solar heat, and the rotation, are supposed to render it an oblate spheroid. But, as it would have central force till the two motions were equal; so, as at the surface of the Earth, at 3958 miles from the centre, it revolves with a total momentum of only 61·02, while the orbit motion is 98,000; then $\frac{98000}{6102} \times 3958 =$ the height which it may rotate, or nearly 64,000 miles from the centre; though peculiarities of elasticity, &c. may alter this result.

The pressure of the atmosphere, on any body, is directly as its solid parts to its own re-acting interstices, or, as the density. This is the cause of the varied action on fluids of different density, when solids are immersed in them, as in capillary experiments.

To compress air into twice its density requires a force of 15 lbs. 3 oz.; at 4 times, it is 45 lbs. 9 oz.; and so for other diminutions less 1. Volumes of pressure are also the number less 1.

The atmospheric pressure, in the mean human body, is 15 tons. An air-tight bath lessens it above half a ton.

Fox considers the pressure of the atmosphere, at the depth of a mile, from the surface of the earth, is equal to 160 atmospheres, and that this prevents water being converted into steam by the great heat.

A cubic foot of air weighs 1·2 oz.; hence, a column a mile high, and one inch base, weighs 43·2 oz., and 15 lbs. is equal to 5·6 miles. It diminishes in weight, as the height; and in elastic force, or re-action, as the bulk or cube of the height, together as the fourth power. In density, it is as the logarithm of the height; hence, at 44 miles, where it ceases to reflect the light, its density *is considered* only a 10,000th of that at the surface.

Air contains about a 1200th part of carbonic acid gas, and a 70th of aqueous vapour. The causes of marshy and pestilential vapours have not been determined, but they yield to re-agents, as nitric acid and oxymuriatic fumes.

As chemists and authors give the fundamental ratios of the gases and air and water differently, and mystify themselves and their readers, these vary in consequence. In the preceding articles, the Editor has endeavoured to reconcile discrepancies.

He takes the cubic inch of water at 252·525 grains, of 7000 grains to the lb. avoirdupois; so that a cubic foot of water, of 1728 inches, weighs 436,363 grains, or 62,336 lbs.

Then, as water is to air as 827·437 to 1, a cubic inch of air weighs 0·305188 grain; or a cubic foot 526,3661, considered as 5 volumes, for 4 volumes of nitrogen and 1 of oxygen.

Oxygen is to air as 1·1111 to 1; therefore, 1 cubic inch weighs 0·3390947 grain, and a foot 585·9554.

Nitrogen is to air as 0·9722 to 1; therefore, 1 cubic inch weighs 0·296704 grain, and a foot 512·706.

Then, 1.5th of 585·9554 = 117·1911; and 4.5ths of 512·706 = 410·1648, which, added, makes 527·3559 for the volume of a cubic foot of air.

Hydrogen is to air as 0·0694 to 1; therefore, the cubic inch is 0·02118, and the cubic foot 36·6 grains.

The French chemists call oxygen 1·10359, and nitrogen 0·96913, to air 1; but the English make them as above, and are probably more correct.

Transparent air only admits a fixed extent of vapour, but more as the temperature or motions of the gaseous atoms expand, and less as they contract by cold, but equal at equal temperatures. Every 27° of Fahrenheit doubles its power of holding vapour. At 59° it holds an 80th, and 86° a 40th, owing to the increased spaces between the moving atoms.

A diminution of a third, in the density of the air, more than doubles the evaporation of water.

Resistance in the air is nearly as the square of the velocity, up to 1000 feet per second. The pressure before is greater than that behind, and that before moves 1300 or 1400 feet per second. Hence, when the velocity is greater, as 1700 feet, the resistance is three times greater, and, at 1600

feet, twice more. Resistance is, also, nearly as the surfaces, acting but more in a much larger surface.

In proof that capillary attraction (as it is called) is mere aërial pressure, if a porous body be immersed in water, and the pores on one side stopped by gum, the water is driven more intensely into the pores on the open side.

Taking platina at 19 5 of water, and air as ·0012, a cubic inch of platina is equal to 16,350 cubic inches of air, and to 221,000 of hydrogen as 0735 of air. Consequently, if platina was volatilized into hydrogen, and its atoms were as platina, the 10,000,000th of an inch asunder, the same atoms as hydrogen would be the 59th of an inch asunder. Water as steam, at 185°, is 72,000 times its own bulk, *i. e.* 3,000,000 times rarer than platina, and, *cæteris paribus*, its atoms are nearly the third of an inch asunder.

Air, of the density of that near the Earth, is opaque in a thickness of 17 miles.

A middle-sized man consumes 46,000 cubic inches, or 26 cubic feet, or nearly a cubic yard of oxygen per day, making 20 respirations in a minute, and 1 62 cubic inch at each. That is, 46,656 cubic inches in 28,800 respirations per day. The nitrogen does not assimilate, and expires in combination with carbonic acid gas.

Atmospherical refraction is 34′ in the horizon, 57½″ at 45°. The lower edge of the sun and moon, in the horizon, is refracted 5′ more than the upper edge.

De Lambre makes the refraction of air, by observation, to be 0·0005888094, and Biot and Arago, by experiment, 0 000588768.

Cassini, in calculating the atmospheric refraction, considered the atmosphere as five miles high, or variable ten miles. But Kramp and La Place considered it indefinite. Ivory conceives that cold limits its expansion, and he assigns a heighth of 50 miles, and has formed a new Table of Refractions for every degree, from the zenith, 50 F. 30 Bar.

°	″	°	″
1	1 02	40	48 90
5	5·11	50	69 62
10	10 3	60	100·85
15	15 66	70	159 16
20	21 26	75	214·7
25	27·4	80	320·19
30	33 72	85	593 84

90 .... 34′ 17″·5

Refraction, near the Earth, is taken as 1-10th in England, and 1-12th in France.

In 1654, Otto Guericke, of Magdeburg, made the first air-pump, which opened a new field to science: and, by the use of which, Boyle, in England, acquired fame.

Under the receiver of an air pump, thoroughly exhausted, rare and dense bodies fall with equal swiftness. Most animals die in a minute or two, but some amphibia live hours. Frogs continue a long while, also adders, unaffected by the rarefaction of the air. An adder, nine days confined, exhibited signs of animation. Vegetation stops, combustion ceases, gunpowder will not explode, magnets are equally powerful, smoke descends, water and other fluids turn to vapour, glow-worms give no light, a bell sounds very faintly, heat is slightly transmitted.

When air is halved in an exhausted receiver, the hydrometer sinks 50°; and, if suddenly reduced to a 64th, it sinks 300° before moisture expands to fill up the vacuum.

A good air-pump rarifies air 300 times, or 21 times that of hydrogen, so the number of atoms in the space, after the rarefaction, is but the 300th. Then, the cube-root of 300 is 6·694, therefore, the atoms are 6·694 times more distant; and, it appears, they then raise the mercury. But the 10th of an inch, in direct ratio, exhibits an elastic force of only 343 grains, instead of 102,209, the first force.—*Ency. Brit.*

Every pneumatic vacuum is filled by an elastic remnant. If 999 cubic inches are withdrawn, the remaining inch expands its orbits so as to occupy the space, and be capable of exhibiting phenomena of elasticity, but varying in force as the exhaustion proceeds.

If a barometer be placed in the receiver of an air-pump, and the air abstracted, it falls below an inch, and then, if sufficient air be let out from an enclosed condenser the barometer rises again to its first heighth. This proves, incontestibly, that the rise is the result of the single action of the elasticity, and has no concern with the weight, mass, or height of the atmosphere.

The Barometer.

Torricelli, a pupil of Galileo, having discovered that no principle of *suction* existed, and that water did not rise in a pump, owing to nature's abhorrence of a vacuum, imitated the action of a pump with mercury, and made the first barometer in 1643, and Descartes explained the phenomena.

The mean heighth of the barometer is the same every where at the level of the sea. It falls, as it ascends, in geometrical ratio, allowing for varying temperature. The vapour in the atmosphere is less above than below, and at the Equator than the Poles.

The variations in the barometer, between the Tropics, is but 0·25 inch, but beyond them 3 inches, and less in elevation than at the sea level; and North winds raise it, while South lower it. Great falls precede increase of temperature, and rises the contrary.

The mean heighth of the barometer, at the level of the sea, in Lat. 45, is 29 922, and air being to mercury as 1 to 10,478, the column of air, of uniform density, ought to be 4·95 miles. The reflection of twilight proves, however, that it reflects at 37 miles, and is less dense, or at least less elastic, in great elevations; for elasticity being an effect of re-action at the surface, it may be as dense, without equal elasticity, as the volume expands and the re-action diminishes.

The surface of mercury in a barometer in rising is convex, because the *friction* of the central parts of the fluid mercury is less than

the friction of the mercury at the sides next the glass; and, in falling, it is concave for the same reason, *i. e.* the increased *friction* between the glass and mercury detains the ring next to it.

If the atmosphere were of equal density, the rise of the barometer indicates a rise of 5·3 miles, but the rise of the barometer depends more on the elasticity than the density, and, therefore, is not a criterion of the height. The greatest depression of the barometer in England has been to 28·1 inches.

Barometers rise and fall together, even at great distances. They fluctuate less at elevations above the sea. Northerly winds raise them, southerly winds sink them.

The pressure of the air keeps the gas among the atoms of fluids; and when the pressure is removed the gas escapes, and the atoms crystallize, as in freezing water under an air-pump. But for this constant and intimate atomic pressure, all fluids would become gases, or crystals.

Its height, as a *uniform* gas, is proved, by its pressure of 2158 lbs. to the square foot, being equal to 5·6 miles. But the Earth's reaction, and the compression into a narrower space, and its own elasticity, afford dilatation as it ascends, in the geometrical ratio of the altitude. Of course, however, this must have *a limit*, and tables which run up an expanding series are *fanciful*. These shew that 1 cubic inch of air, at 500 miles high, would fill a sphere 1800 millions of miles in diameter; that, at 7 miles, it is equal to 4 inches; at 14 miles, 16 inches; at 28 miles, 256; at 42 miles, 4096; and at 49 miles, 16,384. But, probably, no gas is much rarer than hydrogen, or about 13 times rarer than common air.

Atmospheric air is reduced in bulk as pressure increases, or expanded as pressure is removed. Perkins proves, that 2000 atmospheres, or 30,000 lbs. of pressure, reduce it to a liquid.

The weight of the atmosphere compresses water about the 22,000th of its bulk; spirits of wine the 15,000th part; and mercury the 33,000th part. The pressure of water, at the depth of 500 fathoms, diminishes the bulk of the water a 27th.

The variations in the barometer depend upon the varied elasticity of the air. From 10 in the morning to 4 in the afternoon, between the tropics, the barometer falls: it rises till 10 at night, falls till 4 in the morning, and rises again till 10 in the forenoon, in all about a 500th part of the entire elevation. There is much quackery in the words usually written on the plates of barometers, as the changes indicated depend on other circumstances, besides elasticity.

A barometrical day begins at 4 in the morning, when it rises a 500th till 10, and again from 4 till 10 in the evening. But it falls from 10 till 4 by day and night. It falls during wind, because the lateral velocity diminishes the downward pressure.

The weight and elastic force of air raise water, in an exhausted tube, 33 to 35 feet, and quicksilver from 28 to 31 inches, a force equal to 15 lbs. to the square inch, or 20 560 lbs. to the square foot. The weight of the whole atmosphere is, thus, 12 quadrillion lbs.

A column of the atmosphere, equal to 29·82 inches of mercury, is strictly 14·6 lbs., or 14 lbs. 9 oz. and 9 dr., usually taken as 15 lbs. Then, as a cubic inch of air weighs 0·311446 grain, the height of the atmosphere, at equal elastic pressure to the surface, would be only 5·17 miles. But the elasticity is taken to be inversely in geometrical progression of the height in arithmetical progression. In fact, in a table, the logarithm is the height, and the whole number the elasticity. Thus, at 4 miles high it is half; at 7 miles a quarter, and at 10 miles an 8th.

It would require a column of air 26,060 feet high, of the density of that of the surface, to raise the barometer to its average heighth.

Air, by compression, has hitherto been reduced only to an eighth of its natural bulk.—*Brockhaus.*

The water barometer, at the Royal Society's rooms, gives 13·386 inches of rise and fall for every inch of the mercurial column, and about half an inch for every millimetre, the $\frac{1}{25\cdot39}$ of an inch. It leaps up and down at every breeze, and, in its way, enables us to see as well as measure the slightest variations. It even displays aerial elasticity as a moving power.

Barometers are used to indicate the height of mountains, because the elasticity diminishes as the aerial space enlarges. The rule is as follows:—To subtract the logarithm of the number of inches at the top, from the logarithm of the number of inches at the bottom, and the difference, multiplied by 60,000, gives the elevation in feet. Then, to correct this by the variation of the thermometer at the two stations, shift the decimal point three places to the left, and multiply by twice the sum of the degrees on the thermometer at top and bottom; add this to the first determination, and the sum will be the true elevation. For example, in the case of Snowdon, the barometer at bottom is 30·091, and at top, 26·439; the difference of their logarithms is 0·5614, which, multiplied by 60,000 gives 3668·4: to correct which, 3·37 × by 50·8 as above, = 171·2 + 3668·4 = 3589·6, the true height.

There is another rule, by the proportion of the sum of the two heights of the barometer to their difference, as 52,000 to the height; thus, in the case of Snowdon, as 56·53 is to 3·652, so is 52,000 to the height which is to be corrected for difference of heat, as before. The number 52,000 being a constant quantity in this ratio.

At Quito, the barometer stands at 20 inches, and water boils at 140° or 150°. At Micuipampa at 18, and at Antisana at 17, all inhabited. Gay Lussac experienced no inconvenience in respiration with the barometer at 14°.

When the barometer at the foot of a hill is 29·5, at 500 feet high it is 29·007; at 1000

feet 28·523; at 2000 feet 27·579; at 3000 feet 26·668; at 4000 feet 25·786; at 5000 feet 24·933. Or, at one mile, 24·7; two miles, 19·78; three miles, 17·32; four miles, 14·5; five miles, 12·15; and six miles, 10·18. If the first quantity is more or less than 29·5, the same differences may be taken. At 40 miles high, the *received* law of barometrical pressure would give the mercury but ·01 inch.

As an approximation, when the barometer at the foot of an elevation is at 28½° and 30°, and at the top is as under, the heighth, in feet, is nearly as expressed:—

At Top.	*At Foot.* 28½°	30°
15 inches..........	17,000	18,000
16 "	15,000	17,500
17 "	13,500	14,800
18 "	12,000	13,250
19 "	10,600	12,000
20 "	9,250	11,250
21 "	8 000	9,250
22 "	7,000	8,000
23 "	5,500	7,000
24 "	4,500	5,800
25 "	3,500	4,750
26 "	2,400	3,750
27 "	1,500	2,500
28 "	500	1,750

The descent of the barometer one degree centesimal, is taken by Ramond at 540 feet, by Humboldt at 528, and by Gay Lussac at 570 feet.

Twenty-four inches, English, of the barometer, is 609·59 millimetres; 25 inches, 634·99 millimetres; 26 inches, 660·39; 27, to 685·79; 28, to 771·19; 29, to 736·59; and 30 inches are 761·99, or an even 762, so that an inch is 25·4 millimetres, or thousandths of a metre.

The mean height of the weather instruments for the 24 hours of every month, at London, is as under:—

	Ther. deg.	*Bar.* inch.	*Rain* inch.	*Hyg.* deg.
January	36·1	28·92	1·48	1·8
February	38·0	30·07	0·75	3·1
March	43·9	29·84	1 44	4·9
April	49 9	29·88	1·78	6 4
May...........	54·0	29·9	1·85	7·9
June	58·7	30·02	1·83	9·0
July..........	61·0	29·87	2·52	6·5
August	61·6	29 9	1·45	6·3
September	57·8	29·93	2·19	5·5
October	48·9	29·77	2·07	4·1
November	42·9	29·77	2·4	2·4
December	39·3	29·69	2·43	1·7

On days in June, the thermometer gives a mean of the highest at 96°, and in January, a mean of the lowest days 11°, so that there is a mean annual range of 79°. The greatest mean range is in June (90° and 37°). In July, but 34°; and in other months from 39° to 42°.

The barometer is usually one-fifth of an inch lower at the Equator than in 30° lat.

Taking 13·586 as the specific gravity of mercury, 29 inches on the barometer is 32 feet 10 inches of water in the pump, or at 30 inches would be 34 feet.

Thermometer or Temperature.

There are three THERMOMETRICAL scales in general use, by which mercury determines heat from its freezing point, at 40°, below zero, to 600°, where it boils.

The thermometer was invented by Santorius and Drebel, in the 16th century.

To convert degrees of *Reaumur* into Fahrenheit, multiply by 9, divide by 4, and add 32.

To convert *Fahrenheit* into Reaumur, subtract 32, multiply by 4, and divide by 9.

Thus, if 16° *Reaumur* is given $9 \times 16 = 144$. Then $\frac{144}{4} = 36 + 32 = 68°$ Fah.

Or, if 40° *Fahrenheit* $- 32 = 8 \times 4 = \frac{32}{9} = 3\frac{5}{9}$ or 3° 55′ Reaumur.

In the *Centigrade*, much used, 0 or zero of Fahrenheit is —17·78, and 32° Fahrenheit is 0 of Centigrade; 68° of Fahrenheit is 20° Centigrade; 86° of Fahrenheit is 30° of Centigrade; 104° of Fahrenheit is 40° of Centigrade. Every 18° of Fahrenheit being 10° of Centigrade throughout.

Water *freezes* at 32° of Fahrenheit, 0 of Reaumur, and 0 of the Centigrade, and it *boils* at 212° of F., 80 of R., and 100° of Cen.; so that the distance is 180° of F., 80° of R., and 100° of Cen.

Thermometers vary from true heat. 51·26 of true heat gives 50 of Reaumur, and 47·3 by alcohol; and 21·12 gives 20 by Reaumur, and 16·5 by alcohol.

Mercury, for thermometers, is purified by agitation in a bottle with sand, and then by straining it through leather.

No liquid can be used for a thermometer above 680°, and Fahrenheit begins at 32° below the point of freezing water, for 0 or zero; and setting 32 at the freezing point, he ascends to 212, the heat of boiling water; taking 98 as blood-heat, and 176 as the heat at which alcohol boils; 55 as temperate, and 76 as summer heat.

A thermometer, for intense cold, is of alcohol.

Mercury expands, between 32° and 212°, about a 55th, or a ten thousandth of its bulk.

The mean of freezing and boiling is 110°, not 122°, because the expansion increases with temperature.

The mean annual temperature of the whole Earth, at the level of the sea, is 50°. For different latitudes it is as under; the third column showing the height in feet of constant freezing in those latitudes:—

Equator	84·2 deg. ..	15,000 feet.
lat 10	82·6........	14,700
20	78·1........	13,300
30	71 1........	11,500
40	62·6........	9,000
50	53·6	6,300
60	45	3,800
70	38·1........	1,700
80	33·6........	450

The mean daily course of the temperature of the atmosphere is the same at all hours. According to a yearly mean, the coldest hour of the day, in Europe, is 5 o'clock in the morning. The warmest hour

of the day is from 2 to 3 in the afternoon. The rise is most considerable some hours after the minimum, the fall some hours after the maximum. The heat increases for 9-10 hours, decreases for 14-15 hours. The greatest daily range of temperature in Europe is about 13° Fahr. The greatest daily range in Europe, is in July, and the least in December.

Of 10,000 rays falling perpendicularly, 8100 reach the Earth; 7000 at 50 deg., 2800 at 7 deg., and 5 at 0 deg.

Water seldom freezes till the meridian altitude of the Sun is less than 40°.

In latitude 75 degrees, where the mean temperature is only 37 degrees, only moss, lichen, grass, dwarf-willow, and sorrel grow. The Earth, from the equator to the poles, resembles mountains in their kinds of vegetation, from the base to the summit. Humboldt says, the proportions in variety are, in the tropics 12, temperate zones 1, and frigid 0·1.

Elevation above the level of the sea, or the general level of a country, makes a regular variation of temperature. The first 300 feet make a difference of a degree, almost as truly as though the height were measured. This arises from the diminution of reflected heat from surrounding objects. After ascending 300 feet, the thermometer falls a degree at 295 feet, then a degree at 277, 252, 223, and 192 feet; so that at 1539 feet, it falls 6 deg. in a general way, but 300 feet. per degree, is the common rule.

The cold and heat of climates depend, also, on the vicinage of seas. At Moscow, the thermometer ranges from 6° to 70°, but at Copenhagen, in the same latitude, only from 27° to 65°; so, at Vienna, it ranges from 26° to 70°, but, on the French coast, in the same latitude, only from 41° to 67°.

The west side of the old, and the east side of the new continents, present in the same latitudes different mean temperatures, as under:—

	Old Con.	New Con.
30°	70°·5	66°·9
40	63·1	54·5
50	50·9	38
60	40·6	22·2

The western shores of both continents are milder than the eastern.

In lat. 46, 47, and 48, the heat at sun-set is the mean of the day.

When the Sun is in Aries or Libra, the relative heat of the equator, according to Humboldt, is taken at 1000; at 20 deg. is 940; at 40 deg. 750; and at 60 deg. 500. But, when in Cancer, or Capricorn, it is, for the same hemisphere, at 0 deg. 9117; at 20 deg. 1008; at 40 and 50 deg. 1150; at 70 deg. 1175; and at 80 and 90 deg., owing to sun-shine for six months, 1250.

Between the tropics, the variation from latitude is but 8 deg.; lat. 23 deg. 8 min. being 76. In lat. 45, the average heat in summer to that in winter, is as 120 to 42, but the arctic circle as 102 to 12.

The heat, in a general way, may be supposed to arise from the verticity of the Sun in the tropics, and thence is dispersed through the mass.

The mean temperature for a year is found by multiplying the square of the cosine of the latitude by 29. If, at the equator, the annual heat is taken at 232, at the tropics it is 214, at 45°, 162, and at the arctic circle, 114.

The heat, at different altitudes of the Sun, is as the square of the radius to the square of the angle. Thus, at 30° high, the sine is 0·5, and, hence, the heat is but a fourth. This arises from the same cylinder of rays being diffused at 30° over four times the surface. Taken in thickness of atmosphere, it is but two to one. So, at 45°, it is the square of 0·707, or 1 to 2, but the atmosphere is 1·4 to 1.

While air *above* snow is 70 degrees below the freezing point, the surface of the ground *below* the snow is only 32 degrees.

Sudden changes of temperature prevail in Africa. Della lella records one of 27 deg. in 24 hours.

Temperature is so variable in South Carolina, that the thermometer sometimes varies 50 degrees in 24 hours; it ranges no less than 83 degrees in the year. The rain averages 50 inches.

0·00375 is the expansion of air and gases, for every degree of heat on the centigrade thermometer; by Fahrenheit, it is the 490th.

At 40, 50, and 60 feet deep, in different places, we have an invariable stratum of mean heat. At less depth, the distribution accords with theory. From the equator to the poles, the theoretical rule is, that the temperature in every latitude is as the square of its cosine.

January, in London, averages 38° 52′, and in the rural vicinity 34° 16′.—*Howard.*

By several years' observations at Plymouth, it appears that at 5 in the morning, the temperature is constantly lowest. After which it gradually rises to 8° or 9°, in 8 hours, before 1 o'clock, and then falls 16 hours, till 4 and 5 the next morning. At 6 it rises half a degree. It falls, between midnight and 5 in the morning, about 2°. At Leith, the ascent from 5 is 9¾ hours.

The mean temperature of the year at Plymouth, is 52°·9. The highest 80°, and lowest 30°.

At Plymouth and Paris, 9 A. M. and 9 P. M., and at Leith 4 and 4, give the mean of the day.

In Europe, the mean isothermal line of 59°, is in lat. 43; but in North America, in lat. 36. That of 50°, in lat. 51; but in North America 42½. That of 41°, in Europe, is in lat. 59½, but in America, in lat. 48. And that of 32° Fahrenheit is in 66°, in Europe; in America, 54°. Under the line, the mean of Africa is 83°, and America 81½°.

In China and Africa, the thermometer rises to 110 and 113, and even to 125 deg. in the sandy deserts; while, in Hudson's Bay, it falls to 50 and 55 deg. below zero.

Gay Lussac ascended in a balloon 22,890 feet, and at the earth the thermometer was 87°·4, and at his elevation but 11°·9. On

the top of Mont Blanc, 12,210 feet, when the heat at bottom was 73°·4, at top it was 26° 8. At Teneriffe, at the same height, it is 76°·8, and 47°·1. The mean variation at the equator is 1° for every 341 feet. In the temperate zone, it is 1° for every 317 feet, or 12° to 3000 feet.

Generally, there is constant snow on mountains near the equator, at 15,700 feet; at 20° lat., 15,000 feet; at 45°, 8,300 feet; and, at 66°, at 4,900 feet.—*Humboldt.*

De Candolle considers the element of heat as depending on the mean of the year and the extremes.

The solar heat, in a year, is sufficient to melt a coating of ice spread over the globe 46 feet thick.

In London, the mean annual temperature is 50 39 deg. At Edinburgh, 47 deg. At Dublin, 49·4 degrees.

The mean temperature of the four seasons in England, Scotland, and Ireland, is, in the middle of each,

	England.	*Scotland.*	*Ireland.*
Spring	50·2 deg.	41·2 deg.	45·5 deg.
Summer	64·3	56·4	62
Autumn	51	47·7	53
Winter	40 6	37	42

The average heat at London, in the first sixteen years of this century, was 50·93 deg. The hottest day, from 1774 to 1817, was in July, 1808, being 93 5 deg., and the coldest, Dec. 25, 1796, 2 deg. below zero.

The highest temperature, in the Sun's rays, at London, is 154 deg. Fahrenheit, 54·2 deg. Reaumur, 68 deg. Centigrade. The highest of the air, in the shade, 90 deg. Fahrenheit, 26 deg. Reaumur, 32·5 deg. Centigrade. The mean temperature of the air is 49½ deg. Fahrenheit, lowest 11 deg. Fahrenheit, and on the Earth's surface 5 degrees.

In the counties round London, the mean temperature and rain, in every month, is as under:—

	deg.	*inches*
January	36·1	1·483
February	38	·746
March	43·9	1·44
April	49·9	1·786
May	54	1·853
June	58·7	1·83
July	61	2·516
August	61·6	1·453
September	57·8	2·193
October	48·9	2·073
November	42·9	2·4
December	39·3	2·426
	48·5	22·199

In London, the mean of January is 37 36 deg.; of July and August 63·5 deg. In Devonshire, the mean of the year is 52·5 deg. and of the winter 44·5 deg. In Northumberland, 47·7 deg. is the mean of the year, and of winter 37·5 deg. In Shetland, the mean of the year is 45½ deg.

The average temperature of the winter months, in England, is about 40 deg., and of the summer months 65 deg.; Devonshire and Cornwall are about 4 deg. warmer than London.

The annual average of the thermometer, at the north and south points of England, Carlisle, and Sandwich, is 48 deg. and 50 deg.; the maximum, in 1820, 78 and 83; and the minimum was 12 and 27. The mean temperature of Ireland varies from 47 to 53.

At Kinfaun's Castle, N. B. lat. 56 deg. 23 min. the mean temperature, for 1830, was 47·626 The rain 30·85 inches. Coldest day 10 deg., and hottest 79 deg. Barometer from 30·53 to 28·73 inches.

The thermometer ranges between 11 deg. and 80 deg.; the average being 46·6, in lat. 55 deg. 45 min. in Scotland.

The 14th of January, on an average of years, is the coldest in the year.

At Chiswick, near London, the mean heat and dryness in the Horticultural Gardens, have been as under in 6 years:—

1828	51°·6	3°·0
1829	47·8	2·6
1830	49·3	3·4
1831	51·6	2·7
1832	50·8	2·7
1833	50·9	3·1
Mean	50·3	2·9

The mean heat of the year at

	°	′
Petersburgh	38	84
Drontheim	39	92
Moscow	40	10
Stockholm	42	26
Quebec	42	8
Copenhagen	45	68
Kendal	46	4
Edinburgh	47	84
Boston	47	3
Detroit	47	4
Philadelphia	53	7
Richmond	56	1
Washington	58	1
Charlestown	58	5
Dublin	49	10
London	50	36
Geneva	49	28
Vienna	50	14
Bruxelles	51	
Paris	51	08
Amsterdam	51	62
Brussels	51	8
New York	53	78
Philadelphia	53	42
Milan	55	76
Bourdeaux	56	48
Rome	60	44
Cerigo	65	3
Algiers	69	98
Cairo	72	33
Cumana	81	86
Vera Cruz	77	72

In the latitude of London, America is 13° colder than Europe, and in 40 latitude, is 8 6° colder than Europe.

In Massachusets, the hottest years of 42, were—1793, mean 50·96; 1820, mean 50·99; and 1828, mean 51·35. Coldest year, 1812, mean 44·28. The hottest month was July 1825, 77°·74; the coldest, January 1792, 19°·17. The hottest days, 101°, on June

23, 1816; and July 21, 1825. The greatest cold was—13°, January 25, 1821; January 17, 1786; January 23, 1792; February 14, 1817; and January 13, 1818—11°.

Near Boston, the greatest cold during 10 years was on the 1st of February, 1826, 18° below zero; and the greatest heat, on the 11th of July 1825, 99°. From 1821 to 1830, there were, on an average, 219 days of *fair*, and 146 of *cloudy* weather: rain fell, more or less, on 57 days; and the annual average quantity of snow was about 3 feet. The Aurora Borealis illuminated 17 nights, in 1831, and thunder and lightning on 21 days.

At the volcanic islands of the Gallipagos, half a degree north of the equator, the daily temperature is from 74 to 91°.

The Red Sea is as hot as any part of the world. The thermometer ranges, in 14 hours, from 94 to 112. From Babelmandel to Suez, the coast, for 40 miles inland, is a dry sand, without a blade of grass or drop of water.

The cold at Tabreez, in Persia, is so intense in February, that persons are constantly frozen to death.—*Porter*.

In New South Wales, the coldest month averages 54°; and the hottest 75°. It rains 100 days in the year. The north-west wind is a scorching sirocco. The air is generally dry, but the night-dews are heavy.

The thermometer, in Italy, ranges between 75 and 96°; and in winter seldom descends below 40°, except in the Appenines, where it falls to 20°

In the Gulf of Guinea, the thermometer rises to 130°; but Humboldt thinks that in the air it can never rise above 140; at sea, it never rises above 85 or 88.

In the Eastern Archipelago, the thermometer is 88° to 91°, so that decks are not used till evening, and then the damps are very great.

In June, at Socotra, the extremes of the thermometer were 88 and 91.

Belzoni considered the tract between the first and second cataracts of the Nile to be the hottest on the Globe, owing to there being no rain. At Thebes, he says, it rains about three times a year, about half an hour each time.

At Bagdad, in summer, the thermometer is from 112 to 122.

The extreme temperatures of India at the level of the sea, for its most N. and S. parts, are 66° and 83°. The thermometer ranges at Calcutta from 70° to 95°; at Madras from 70½° to 91·6, with 110° often in the interior.

In Australasia, the thermometer, in summer, ranges from 102° to 54°; and in winter, from 66° to 42°. There is no snow, and very slight moving frost.

The temperature, in equal latitudes, is from 4 to 8° lower in the southern hemisphere. It is supposed to arise from the extended surfaces of water, and from the Sun passing through the southern signs in 7¾ days less than the northern.

The climate of the southern hemisphere is more equable than the north. In May, at Cape Horn, lat. 56, equal to our November; vegetation is flourishing.

The sea is colder in the south, and ice extends 4 or 500 miles further from the South Pole than the North. There are currents from the poles towards the tropics, and then from east to west, in conjunction with the trade-winds.

The southern hemisphere is even so much colder than the North in Europe, that Sandwich Land, in the lat. of Scotland, is covered with snow through the year; and icebergs descend 10° nearer the equator than in the North Atlantic.

At 30° of lat. on the Old Continent, the mean heat is 70°·7, but on the New Continent only 67°·1. At 40 lat. 63°·5 and 54°·5. At 50 lat. 50°·9 and 38°·3; and at 60° lat. 41° and 25°. The cause is, the masses of the Old Continent, which revolve nearer the axis, while the comparative strip of America revolves, perhaps, 2 or 3000 feet higher.

The mean annual temperature at Montreal, lat. 45° 31′, varies from 47° to 42°. The spring from 58° to 50°; the summer from 78° to 69°; the autumn from 44° to 33°; and the winter from 15° to 23°. In 1835, the highest was 98°, and the lowest 25°. The mean 61½.

The mean temperature, per Parry, for the 6 winter months, was at

Winter Island, lat.	66° 30′	— 11°·7
Igloolik . . .	69° 20′	— 18°·3
Melville Island .	74° 45′	— 24°

No snow fell at Melville Island, and only 9 inches at Winter Island. An iceberg, seen by Parry, was above 250 feet out of the water, and, therefore, 1800 feet thick.

The mean temperature of the North Pole is estimated at 4° or 5°; but others take it a mean of 1°, and even at 3·5°.

At Bear Lake, Captain Franklin, on Feb. 7, found the thermometer at 58° below zero, and for two days it had been 57·5°.

In Siberia and Hudson's Bay, mercury sometimes becomes solid, proving the cold to be 39° below zero. Wine and spirits become a spongy mass.

Spring, summer, and autumn, last but 3 months in the lat. of 70°, and corn and fruit cease in lat. 65°.

Icebergs have descended to the Azores, and to Cape Horn, and permanent ice exists 10° further from the South Pole than the North.

Spring is the most rapid in the Arctic regions. The snow disappears, and birds of passage re-appear. Then, within a few days, the trees burst into foliage, the ground is covered with flowers, and mosquitoes are thawed in millions, which, with horse-flies, sand-flies, &c. &c. render summer less comfortable than winter. Spiders, frogs, fish, &c. frozen, and as brittle as ice, revive with the thaw.

The frozen ground in Siberia is permanent to the depth of 400 feet.

In many districts of Siberia, the thermometer, when the days are but 1½ hour, stands at 33° below zero.

2 A 2

In Northern Siberia, the ground is frozen to the depth of a furlong, and the summer sun thaws it but 3 or 4 feet. Below the furlong, however, internal heat commences, and, at the depth of 4 miles, it is believed that the heat equals that of melted lead.

At Yakuzk, in Siberia, mercury is always solid 2 months in the year, and often for 3 months. The mean temperature is — 6° R. and the ground is constantly frozen to the depth of 400 feet, indicating that 400 feet is equal to + 6° R., since at 400 feet it thaws.

Beaumont and Brogniart determine that the mean heat at Paris must, in the early part of the *tertiary period*, have been about 72°; that of modern Cairo, which bespeaks an expansion of the Tropic, 18° or 18×7500 years, or 135,000 years. Coral reefs existed at Kirkdale, (54½°) in the preceding carboniferous period. The breadth of the Tropics then destroyed polar ice, a great cause of the cold of high latitudes The central heat must have been, as now, 32 yds. to a degree.

In the past century, the severe frosts in England were in the winters of 1708, 1715, 1739, called the hard frost. 1742, 1754, 1776, 1788, 1796, and 1813

The mean heat at Bruxelles, 51°, was lowered at 40 inches depth, but at 80 inches it stood at 52° 4′, from 13 to 25 feet at 33° 40′. At 25 feet depth the difference for the year was but 1° 51′, while at half a foot it was 12° 1′.

At Jarrow colliery, depth 900 feet, when water at the surface is 49°, at the bottom it is 68°. Air is 49½° and 70°. At Whitehaven, air at surface 55° is 63° at 480 feet, and 66° at 600 feet deep. At the Percy main, 900 feet, air is 42° and 70°, and water 49° and 68°.

At one foot deep in 2 years, a thermometer at a mean for each, was 43° 8′, and 44° 9′. At 2 feet 44° 1′ and 45° 9′. At 4 feet 45° 1′ and 46° 2′. At 8 feet 46° and 46° 5′.

The deepest coal-mine in England is at Killingworth, near Newcastle, and the mean annual temperature, at 400 yards below the surface, is 77 deg., and at 300 yards, 70 deg.; while at the surface it is but 48 deg., being about 1 deg. of increase for every 15 yards. This explains the origin of hot-springs, for, at 3300 yards, the heat would be equal to boiling water, taking 20 yards to a degree. The heat of the Bath waters is 116 deg., hence they would appear to rise 1320 yards.

By experiments made at the Observatory of Paris, 51 feet depth corresponds to the increase of 1 deg. Fahr. Hence, the temperature of boiling-water would be at 8212 feet, or about 1½ miles English, under Paris.

In lat. 56° 10′, by keeping thermometers fixed in the ground at various depths, it appears that frost does not penetrate so deep in the earth as a foot. At the depths of one, two, and three feet, the lowest temperature, during two years, was, at 1 foot, 33 deg.; at two feet, 36 deg.; and at three feet, 39 deg.; while the highest was, at one foot, 35 deg.; two, 52·5 deg.; and three, 52 degrees.

By other observations, at one foot, it varies 25 deg. in the year; at 2 feet, 20 deg.; at 4 feet, 15 deg.; at 8 feet, 9°·5; and at 31 feet, 2°7. At 40 or 50 feet, there is no variation.

The Earth is believed to increase, in heat, a degree in every 15 or 20 yards depth.

In the catacombs at Paris, the thermometer through the year is between 52 to 54 degrees, while on the surface it varies from 90 degrees to 0 deg. In Mexican mines, it stands constantly at 74 degrees.

The temperature of the bottom of a Cornish mine is 3 deg. above that of the surface. Granite is colder than killas.

The internal heat may be taken about 1 deg. of R. or 2·25 of Fahr. for every 100 feet of depth.

Fourier estimates, that if below 180 miles the interior was incandescent, it would raise the surface but the 10th of a degree; and, if 100 times hotter than iron at a red-heat, it would, in 200,000 years, raise the surface but 1 degree. But at 40 or 50 miles it would be 1 degree in 2000 years. The present central heat (if any) would, says Fourier, only melt an inch of ice per annum. He and Swemberg calculate the heat of the celestial spaces at 50 deg. centigrade below freezing.

The winter temperature of the Atlantic is about 54 deg., of the Irish Sea 51 deg., and of the German Ocean, flowing from the North, 43 deg. in winter, and 53 deg. in summer.

At great depths in the sea, as 4000 feet, the difference is from 15 to 22 degrees between the air and the water at that depth; and, at 4680 feet, the water is 26 degrees, while the air is 48½ degrees.

Sabine, near Cuba, in lat. 20½ north, sank register thermometers above 6000 feet, and found in the depth of the sea 45°·5 and 49°·5, the surface being 82°·5 to 83°.

The lake of Geneva, at the depth of 1000 feet, is always 42 deg., and no variation takes place below 160 feet.

In a lake near Rome, at 490 feet depth, the thermometer is 44°·5, though at the surface it is 77°.

Variation does not take place in water below 120 feet.

In Scotland, on the surface of Loch Lomond, the thermometer stood at 59·3, but at 90 feet it fell to 43·7, and at 240 was 41·3; and at 690 was 41·1.

The German Ocean is 3 deg. colder in winter, and 5 deg. warmer in summer than the Atlantic.

The temperature of perennial springs is identical with the mean of the atmosphere. But in warm countries, the temperature of springs is some degrees below that of the atmosphere.

Peron relates, that, at the depth of 2144 feet in the sea, the thermometer falls to 45 deg., when it is 86 deg. at the surface.

The thermometer, in sea-water, falls from 4 to 6 deg. on approaching land.

In 860, the Rhone was frozen; in 1133, the Po; in 1305 all the rivers in France; in 1334, a frost, of 2 months and 20 days, froze all the rivers of Provence and Italy. In 1594, the sea was frozen at Marseilles and Venice. In 1657 and 1667, the Seine was frozen 33 days.

On July 8, 1793, at Paris, the Centigrade thermometer stood at 38°·4 (101 Fahrenheit). And on Jan. 14, 1747, and 71, at — 13°·6 (7½ Fahrenheit).

A great snow, in 1614, lasted from Jan. 15 to March 12.

Pluviometer and Rain.

A cube of air at 68 Fah. contains 252 grains of water; and the whole atmosphere, compressed from 100 deg. to the freezing point, would deposit but five inches depth of water on the surface of the whole Earth; though in currents of air it might deposit more in a single district.

But if the *entire* atmosphere, twilight height of 44 miles, were condensed into the density of water at the surface, the depth would be about 36 feet, and concentrated on the seas about 54 feet.

The bulk, and specific gravity of rain-water is taken at 60 deg. as 1. Less heat diminishes its bulk, and increases its specific gravity. At 40 deg. bulk is ·9907, and sp. gr. 1·00094. But, at 80 deg., the bulk is 1·00242, and the sp. gr. ·99759; and at 100 deg. is 1·006 and ·99402.

Drops of rain vary from 1-25th to 1-4th of an inch in diameter. They fall till resistance renders their velocity uniform, and increasing as they fall, they fall according to size, with the final velocity of a falling stone.

There are 72 drops to an inch in the rain of rain-bows, and 200 to 1000 in other cases.

Rain-guages determined the fall of rain at the top of York Minster, in a year, to be but 8·294 inches; and on the ground to be 15·939, and at an intermediate elevation, 12·135. In 3 years, the ratios were 59·15, 79·14, and 100.

Crossley's Rain Guage consists of a funnel of the usual form, through which the rain passes to a vibrating trough, when, after a sufficient quantity has fallen into its higher side, it preponderates, and discharges the rain, which escapes by a tube, and at the same time, by its vibratory action, moves a train of wheel-work and indexes, to record upon a dial-plate the quantity of rain fallen.

The heigtith of humidity is 2 miles in the Arctic Regions, and 4½ at the Equator.

The air is capable of absorbing the 160th part of its weight in aqueous vapour at 32 deg., an 80th at 59 deg., and half more at every 27 deg. of its heat. So that in summer-heat at 86 deg. it absorbs a 40th, and in the torrid zone at 113 deg. a 20th. So far Leslie, but there is an equivoque, since water itself evaporates as steam, as temperature varies.

The air dissolves and receives fluids at all temperatures; but the fluids are converted into gas, only when the excitement overcomes the atmospheric pressure.

In the temperate zone, the annual evaporation is 37 inches, but in the tropics from 90 to 100; and the mean quantity of rain is in the same proportion.

A still surface of water would, in this climate, in winter, lose but the 0·018 of an inch, but in summer 0·048.

Evaporation is as the surface of water, and as the temperature.

The mean quantity of water held in a cubic foot of air, in this climate, is 3·789 grains.

There would be no interval between the solid and vaporous states, but for the pressure of the atmosphere. All liquidity is the effect of atmospheric re-action, and this is overcome when the force of the atomic motion of heat exceeds the compressive of 15 lbs. to the square inch. Hence it is, that water fills the receiver of an air-pump with steam, and that it boils at such low temperature in elevations where the barometer falls considerably. The boiling point would, therefore, be the measure of the relative force of the atoms of bodies, if their levity or their weight were the same. Thus, ether rises against the 15 lbs. at 98 deg., water at 212 deg., and mercury at 650 deg. The relative forces must, therefore, be as 650, 212, and 98, or, the forces being the same, 15 lbs.; the weight of the atoms to be moved must be inversely as the same numbers.

The evaporation of water, owing to changes of temperature in a year, near London, is 23 974 inches, making about 100th of a grain per square inch per minute, and the average quantity in a cubic foot of air is 3·789 grains less in the 4 winter months, and more in the 4 summer, or as 1 to 8 and 9 in January and June.

Clouds are the moisture of a cold region of air condensed in small globules.

Clouds gather about the tops of mountains because the currents of vapour dash against the sides, and collect at the top, and not owing to any attraction.

Dense clouds float, because the air in their interstices are warmed by the Sun. But, as air is hotter near the Earth, there are constantly ascending currents.

There are seven classes of clouds:—

1. Like a lock of hair, or a feather, called *Cirrus*.

2. A cloud in conical round heaps, called *Cumulus*.

3. A level sheet, called *Stratus*.

4. A system of small round clouds, *called Cirro-cumulus*.

5. The concave or undulated stratus, called *Cirror-stratus*.

6. The cumulus and cirro-stratus mixed, called *Cumulo-stratus*.

7. A cumulus, spreading out in cirrus, and raining beneath, called *Nimbus*.

The *cirrus* is the most elevated—sometimes as a gauze veil—or parallel threads. Its heighth is from 3 to 5 miles. When its streamers point upwards it is falling, and indicates rain; when downwards, no rain.

Clouds and fogs are the same thing. We see the whole as a cloud, at a distance in the atmosphere, but when the vapour sinks to the earth, or will not rise, we are immersed in it, and call it a fog. Dew fogs, which hang over fields, are *stratus* clouds; but fogs which involve elevated objects, are *cumulus* clouds.

Most atmospheric phenomena take place within the heighth of 3½ miles, though cirrus clouds were seen many miles above the 4-mile tops of the Andes.

Cirrus clouds are seen over-head, on the tops of the highest Andes, and on looking over the sea, at the heighth of 10 or 11,000 feet, a stratum of mist is visible. Here, however, the sky is clearest, but it loses part of this clearness in passing from the high lands in the Torrid Zone, north or south.

The *Cirrus*, or curling cloud, is always uppermost, and often 5 or 6 miles high. It portends rain and wind. The *cumulus*, or stacked cloud, low and massive. The cirro-stratus is long and flat, or in wavy bars, and often in broken patches like a mackarel's back.

Clouds, in heavy weather, are seldom above half a mile high; but, in clear weather, from 2 to 5 miles, and cirrus from 5 to 7. They are often of enormous size, 10 miles each way, and 2 thick, containing 200 cubic miles of vapour.

A cloud is a congeries of little bladders of water, at small distances from each other, usually not the 1000th part of an inch in diameter, but very different. It is believed that they rotate, and hence their distance and force as steam.

In the 5 summer months 219 clouds passed above 1050 yards high, and 5 winter months only 126. The vapour plane is, therefore, taken in London to be in Jan. 900 feet high, and in July 3270. The air is, therefore, more densely charged with vapour near the ground, and rain-drops augment in falling. Another set of observations 6 feet, 134 feet, and 81 feet high, gave 19·41 inches, 18·81, and 16·53.

When rain takes place, the nimbus cloud is formed. A cumulus becomes at rest, and a cirrus, or cirro-stratus settles on it, and the whole change to cumulo-stratus, first black, and then grey. The fall of rain forms cirrus-fibres, which afterwards float in small cumuli, and the nimbus rises, and is separated.

Air cooled below the dew point, or the temperature of saturation, deposits moisture or rain, which is displayed as fog, sleet, snow, or hail.

Hutton ascribes rain to the mixture of 2 volumes of air of different temperature and saturation. Howard to the electrical of the clouds on one another.

Dew is the condensation of aqueous vapour by a body, which has radiated its atomic motion of heat below the atmospheric temperature. Clouds radiate heat, and restore to bodies what they radiate, and hence, are unfavorable to dew. A white or hoar-frost, is the ice of dew. Filaments, grass, leaves, hair, glass, &c. receive most dew. The chief metals none, nor rocks and bare earths. The dew, per annum, is 5 inches.

Atmospheric air, at the freezing temperature, contains from a 200th to 160th of its weight of water, and double at every 22d or 27th degree. At 52 deg. it contains 100th. at 74 a 50th, and at 98 a 25th. Hence, as cooled, it deposits the excess, and this is the *Dew* of clear and calm nights. The Earth is more heated by the solar rays than the air, and by night the Earth parts with more heat than the air, so as to become lower than the air. In light substances, in contact with the Earth, it is often from 15 to 20 deg. Hence, 10 grains of wool, on a grass-plot, in a night, gave 16 grains of dew, 9 on a gravel walk, and 8 on mould. Hoar-frost is frozen dew. Grass is often but 30 deg. when the air is 39, and hence early freezing.—*Wells*.

Crystals of snow are from 0·123 to 0·03 of an inch in diameter. Their figures are diversified stars. The red colour of some snow is ascribed to a fungus which grows on the snow. The chemical difference between rain and snow-water was determined by Margraaf to be very slight.

Hail-stones fall with a velocity of 60 or 70 feet per second. Rain from 10 to 30 feet. From 3 to 400 tuns of rain fall annually on every acre in England.

Two strata of clouds and 2 of wind are necessary to the production of hail. The clouds are in opposite electricity, and the restoration, by a flash, precipitates the lower to the Earth, itself always negative.

The mean dryness is taken by Daniell at 8.

The average fall of rain, in the United Kingdom, is about 34 inches; but, in the western and hilly counties, it is 48 or 50 inches.

Humboldt assigns 96 inches of annual rain to the equatorial zone. 80 to lat. 20, 29 to lat. 45, and 17 to lat. 60. From three to four times as much rain falls in a year between the tropics as in higher latitudes; yet the number of days on which it rains generally increases as the latitude.

The mean fall of rain in Middlesex is 23·1 inches, least in February and most in July. It is 1½ in January, March, and August; ¾ in February; 1¾ in April, May, and June; 2½ in July; 2 in September and October; and nearly 2½ in November and December.

At Lyndon, in Rutland, there were in the four years 1740 to 1743, 66·361 inches of rain, mean 16·59 per annum. From 1741 to 1750, the mean was 18½; from 1751 to 1760, mean 22·125. From 1761 to 1770, 23·25. From 1770 to 1780, mean 26 inches. In the four years from 1772 to 1774, the mean was 31·239 inches. This indicates a cycle of weather on a change of climate.

Kendal is the wettest place in Europe, its annual fall of rain being 54 inches, and at Lancaster. South, it is 39¾, and Dumfries, North, but 37.

The average rain in London for 40 years,

between 1777 and 1817, was 20·686 inches. At Paris, in 15 years, 18·649. At Glasgow, in 17, was 21·033; and at Manchester, in 33, was 36·104. At Kendal, 1830, 58·03.

Paris has 18½ inches nearly. Liverpool, called a wet place, has 34½.

In 1800, the quantity of rain at Cambridge was 25·62; West Riding of Yorkshire 26·9; Lincoln 24·11; Chatsworth 26·73; Lancaster 35·93; Kendal 48·2; Exeter 24·5; Plymouth 35·5.

At Edmonton, in 1831, the highest ther. was 82 deg., and lowest 10 deg.; bar. 30·5, and 28·9. Rain 26·8. Winds 232 days westerly, 8 north, 6 south.

At Cheltenham, 1831, ther. highest 77·5, lowest 25; bar. 30·26, and 28·52. Rain 34·6. Winds 166 days westerly, 36 north, and 55 south.

At Dublin, about 26 inches, and at Cork 36 inches rain.

On May 20, 1827, 6 inches of rain fell at Geneva, in 3 hours. From September 23 to 27, there fell at Montpellier 15 inches 8 lines of rain. In 48 hours, from the 24th to the 26th, 11 inches 10 lines of rain fell near Montpellier. At Jogeuse, near the Rhone, on the 9th of August, 1807, it was 9 inches 3 lines. On the 9th of October, 1827, there fell 29 *inches 3 lines of rain*, in 22 hours; and 11 days, gave 36 inches.

The rainy season between the tropics is when the Sun is in vertical signs; and at other times there is not a cloud for months. North, the rainy months are between April to October; and south, from October to April.

Rain, within the tropics, is not of the drizzling character of rain in the temperate zone, but generally falls in such torrents, as, in other zones, would be called water-spouts; and they produce greater floods in a single day than in Europe in six days. Winter is distinguished from summer, chiefly by the quantity of rain, which is often constant for many days together, and lasts a certain number of hours per day, through 6 months. The rivers, in consequence, overflow; and, on drying off, make the atmosphere unwholesome.

In middle and lower Egypt it never rains, and the excessive fertility arises from the flood of the Nile. The natives do not credit the phenomenon of water falling from above. Hence it is, that all monuments are so nicely preserved. Buckingham found a building, left unfinished 3 or 4000 years since, and the ochrous marks of the workmen still perfect. Nothing abrades, nothing corrodes.

A fog hangs for six months over Peru. Rain so seldom takes place, that a shower is a great calamity, since nothing is provided against one.

At Bombay, in 10 years, 78 inches per annum fell; in 1822, 113 inches; and, in 1824, but 34. In the Brazils, in 1821, 280 inches fell; and in Cayenne, 160 inches in February only. At Cumana, it is but 8 inches in the year. But in Peru and Egypt it seldom rains.

The fall of rain on the Malabar coast often exceeds 120 inches per annum, and at Madras but 50·2.

Far more rain falls in the western tha our eastern counties. The mean is about 30 inches, and near London 23·1, equal to 3000 tons to an acre. More by night than by day.

Kirwan endeavoured to calculate the probabilities that particular seasons were followed by others.

In forty-one years there were
6 Wet *Springs*, 22 dry, and 13 variable
20 Wet *Summers*, 16 dry, and 5 variable;
11 Wet *Autumns*, 11 dry, and 19 variable.

A season is accounted *wet*, when it contains two wet months. The quantity of rain, in *dry* seasons, is less than 5 inches. In *variable* seasons there falls between 30 lbs. and 36 lbs., each equal to ·157639 of an inch.

A *dry Spring* was followed by
a dry Summer 11 times
a wet 8
a variable 3

A *wet Spring* was followed by
a dry Summer 0 times
a wet 5
a variable 1

A *variable Spring* was followed by
a dry Summer 5 times
a wet 7
a variable 1

A *dry Summer* was followed by
a dry Autumn 5 times
a wet 5
a variable 6

A *wet Summer* was followed by
a dry Autumn 5 times
a wet 3
a variable 12

A *variable Summer* was followed by
a dry Autumn 1
a wet 3
a variable 1

Kirwan then deduced the probability of the kind of seasons that would succeed by the numbers, in 41 years of observations.

In the beginning of any year,
The *probability* of a *dry Spring*, is as 22 to 41
of a wet as 6 to 41
of a variable as 13 to 41
of a *dry Summer* is as 16 to 41
of a wet as 20 to 41
of a variable as 5 to 41
of a *dry Autumn* is as 11 to 41
of a wet as 11 to 41
of a variable as 19 to 41

After a *dry Spring*, of
a dry Summer, is as 1 to 22
a wet as 8 to 22
a variable as 3 to 22

After a *wet Spring*, of
a dry Summer, is as 0
a wet as 5 to 6
a variable as 1 to 6

After a *variable Spring*, of
a dry Summer, is as 5 to 13
a wet as 7 to 13
a variable as 1 to 13

After a *dry Summer*, of

a dry Autumn, is	as	5 to 16
a wet	as	5 to 16
a variable	as	6 to 16

After a *wet Summer*, of

a dry Autumn, is	as	5 to 20
a wet	as	3 to 20
a variable	as	12 to 20

After a *variable Summer*, of

a dry Autumn, is	as	1 to 5
a wet	as	3 to 5
a variable	as	1 to 5

The *probability* of the Autumnal weather will be attained much more perfectly, by taking into consideration the preceding Spring.

After a *dry Spring* and dry Summer, the probability of a

dry Autumn, is	as	3 to 11
wet	as	4 to 11
variable	as	4 to 11

After a *dry Spring* and *wet Summer*, of a

dry Autumn, is	as	2 to 8
wet	as	0 to 11
variable	as	6 to 8

After a *dry Spring* and *variable Summer*, of a

dry Autumn, is	as	0 to 0
wet	as	2 to 3
variable	as	1 to 2

After a *wet Spring* and *dry Summer*, of a

dry Autumn, is	as	0 to 41
wet	as	0 to 41
variable	as	0 to 41

After a *wet Spring* and *wet Summer*, of a

dry Autumn, is	as	2 to 5
wet	as	1 to 5
variable	as	2 to 5

After a *wet Spring* and *variable Summer*, of a

dry Autumn, is	as	1 to 41
wet	as	0 to 41
variable	as	0 to 41

After a *variable Spring* and *dry Summer*, of a

dry Autumn, is	as	2 to 4
wet	as	0 to 41
variable	as	2 to 4

After a *variable Spring* and *wet Summer*, of a

dry Autumn, is	as	1 to 7
wet	as	1 to 7
variable	as	5 to 7

After a *variable Spring* and a *variable Summer*, of a

dry Autumn, is	as	0 to 41
wet	as	0 to 41
variable	as	0 to 41

Winds.

On the westerly and S. W. winds of Europe depend its rains and fertility, but the rains fall as the clouds from the Atlantic advance from west to east. Thus Ireland and the western coasts of England have more rain by 10 or 15 inches than the east of England, and from 15 to 20 more than Germany. The north and easterly winds proceed from tracts of land, cold, and devoid of moisture.

Our northerly and easterly winds are, to our southerly and westerly winds, as 142 to 223.

In England, in a mean of years, we have north wind 30½ days; N. E. 45¼; East 26¼; S. E. 39; S. 23¾; S. W. 73¾; W. 70¼; N. W. 55¾.

No cycle of winds and weather has yet been determiued, though mean periods have been approximated.

A rarefaction and ascent of air takes place in the tropics beneath the Sun, and a re-condensation at the heighth of 5 or 6000 feet; in that region, the effect is a current following the solar vertical, and directed towards it from the N. E. and S. E. at lower heighths, varied by sea and land, by mountains, &c. &c. even to the poles.—*Lind.*

In Ohio, south-west winds are to north-east as 221 to 106, and to north-west as 221 to 136.

When a wind, usually warm, is cold, it is the descent of a cold upper current; or, if after a change, from the return of a cold wind that has passed.

Easterly winds, so pernicious to the human constitution, in England are highly beneficial to agriculture, by drying the soil and breaking the clods of heavy soils and fitting them for crops.

As the sea forms a moving base to the atmosphere, its tides and currents, and the currents of rivers, produce winds and some fluctuations in connection with the ages of the moon.

Professor Schubber, by twenty-eight years' observations, concludes that south and west winds prevail mostly from the new moon to the second octant (the middle of the first and second quarters), and that east and north winds are more common in the last quarter.

Colonel Reed maintains, by laborious observations, that in hurricanes the wind is carried in a vortex, and hence is in contrary direction, in opposite parts of the circle. But Mr. Espy, of Philadelphia, by another series of observations, determines that the wind in hurricanes proceeds as from the periphery of a circle to its centre. Both theories point to some more general disturbance than the theory of rarefaction can account for. Even common storms seem to have connection with some disturbance in the equilibrium of the Earth's motions, which disturbance first shews itself in the parts most sensible of motion, and the adjustment is effected by the storm or hurricane. A velocity of 18½ miles, per *second*, in so heterogeneous a mass as the Earth, cannot fail to produce at times such forces as those in hurricanes, for which the visible agents often appear to be inadequate.

The West India hurricanes are vortexes, as appear by the varied direction of the trees which they prostrate.

A West India hurricane has blown heavy cannon out of a battery, and carried a child over a 9-feet wall.—*Halliday.*

A West India hurricane reached Newfoundland, 3000 miles, in 6 days; another, 2300 miles, in 6 days. They affect at once,

as an immense whirlwind, a space of from 100 to 500 miles in diameter, and progress northward from 12 to 30 miles an hour, but their force is not in the direction of their progress. They commence with wind from the south and south east, and end from the north and north-west, at places in the centre or axis of the hurricane or whirlwind. The barometer sinks at the commencement, and rises at the close. The sea swells around the track of the centre.

In the Indian ocean, the trade-winds are disturbed by the mountains and the large tracts of land presented by Africa and Asia; hence, in maintaining the equilibrium of the atmosphere, the wind, instead of blowing from east to west, takes opposite currents for *six months*, and, at the times of change, produce tornados and storms by what are called the breaking up of *the Monsoons*, which is the name of the six months' wind.

To the south, from 10 deg. to 23 deg., the wind blows constantly from the east and south-east, because lands do not much interfere; but from 10 deg. northward to the equator, north-west winds blow from *October* to *April*, and south-west from *April* to *October*: and north of the equator to the Tropic of Cancer south-west winds prevail from *April* to *October*, and north-east winds from *October* to *April*.

The Samiel is a hot noxious electrical wind, which passes over the sandy deserts of Arabia and Africa. It moves with the quickness of lightning, and passes in narrow currents for a few minutes. It occasions, as is reported, instant death to every man or beast happening to face it; and, it is said, that it so decomposes them that their limbs fall asunder. The approach of it is indicated by a thick haze in the horizon; and travellers, if they have time, throw themselves on their faces with their feet towards it till it has passed. Hewlett thinks that it was a Samiel that destroyed the army of Sennacherib, and Manetho concurs.

The sirocco is a blighting hot wind, which prevails in Italy, &c. about April.

Wind is determined by the anemometer, by Lind, Daniel, and others, to move with velocity and force as under:—

	miles per hour.	force in lbs. per sq. foot.
Gentle	4·5	0·079
Pleasant	8·0	0·260
Brisk Gale	16·0	1·107
High	36·0	5·208
Storm	62·0	15·625
Hurricane	88·0	31·25
Great Hurricane	120·0	58·0

It is, however, impossible to reconcile the force of winds in storms, and, in truth, to account for storms, &c. &c. on the theory which refers every thing to mere rarefaction.

A sensible current of air is about 3 feet 3 inches *per second*; a gentle wind, double; a brisk wind, 16½ feet; a strong wind, 33 feet; and a violent wind from 66 to 80 feet; a storm which overturns trees, &c. 150 feet per second, or 540,000 in an hour, *i. e.* 110 miles.

The force of wind is, as the square of the velocity by the density.

Winds increase in force with elevation, or non-interruption.

Wind moving 100 miles an hour, or 147 feet per second, in a hurricane, acts on a square foot with a force of 49 lbs. At 50 miles, or half, with only a *fourth* of the force 12¼ lbs. At 25 miles, with only a 16th, or 3⅛ lbs. The same law of the inverse square of the velocity gives a force of 1 lb. at 14 feet, or very nearly, and so on.

Windmills are used for grinding corn, and dressing flour for the baker, by the force of wind, and the sails often move 30 miles an hour. From the experiments of Smeaton, it appears that the following positions are the best. Suppose the radius to be divided into six equal parts, and call the first part, beginning from the centre, one, the second two, and so on, the extreme part being six:—

No.	Angle with Axis.	Angle with the Plane of Motion.
1	72 deg.	18 deg.
2	71	19
3	72	18
4	74	16
5	77½	12½
6	83	7

0·33 of the wind acts on a good sailing-vessel, and 0·4 on a fast-sailer. So that the rate of the vessel divided, 0·33 or 0·4, gives, as quotient, the velocity of the wind, allowing for traverses, &c.

Air is rendered very deleterious by gases and vapours generated in the earth. In a certain valley, in the island of Java, carbonic acid is thrown out in such quantities, that no animal can there exist, and birds flying low drop dead. At Fahlan, in Sweden, noted for copper mines, the mineral exhalations so affect the air, that silver in the purse becomes discoloured. In Carniola and Campania, the air is impregnated with sulphur, and it has also been found to contain arsenic. That such poison arises from subterranean action, may be inferred from the destruction of millions of fishes.

Depths of undisturbed air are like water. In a silver mine in Norway, 309 feet deep, the bottom is covered with snow, and so in other deep caves.

The resistance of the air to a cannon-ball of 2 lbs. weight, with a velocity of 2000 feet per second, is more than exceeds 60 times the weight of the ball.

Hutton says, such is the air's resistance, that an iron ball 3 lbs. weight, diameter 2·78 inches, thrown with a velocity of 1800 feet, is resisted by a force equal to 176 lbs., above 58 times its own weight. And a ball of 1·05 lbs., discharged with a velocity of 2000 feet, will ascend only 2920 feet, little above half a mile; whereas, in vacuo, it would have ascended 11·75 miles.

The super-incumbent pressure so drives water into the pores of wood, at great depths

in the sea, as in an hour to increase its weight 21.25ths, and its bulk 1.20th.—*Scoresby.*

Diving has lately been facilitated by the use of an air-pump to force air, for respiration, into an enclosure for the head of the diver, fitted with glasses. The dress is caoutchouc. In this way a diver may walk at the bottom of the sea.

Meteorologists, for comparison, observe at 8, morning and evening, and at 2 in the afternoon. The instruments are the thermometer, barometer, hygrometer, rain-guage, and anemometer.

Prognostics of weather are mingled with all kinds of *superstition and quackery.* The barometer rising (with a convex surface) is a legitimate sign of fair weather; and, sinking (with a concave surface) a sign of wet. The only correct prognostic is an average of 2 or 3 years, and a register of the past; since the average will arrive. Thus, we know that London averages nearly 21 inches of rain, and if 20 have fallen before Michaelmas, there is a high chance the next 3 months will be dry.

Astrologers and almanac-makers have long asserted that the phenomena of the weather, as well as the eclipses, &c. recur every 19 years; but as the effect of the apsides is greater than the syzygies, the revolution of the apsides in 8 years 10 months cannot be neglected. They coincide in 15 revolutions of one to seven of the other, *i. e.* nearly every 133 years; hence, if the moon govern the weather, the year 1838 ought to have corresponded pretty nearly with 1705, and 1839 with 1706.

At and near the equator is found the general easterly wind, which we call the General Trade Wind. It blows regularly and constantly, with small exception, in the South Sea, where there is a large expanse of surface clear of lands, small islands excepted; also, in the middle of the equatorial part of the Atlantic the trade-wind is not less regular and constant. The rotatory motion of the Earth carrying the surface continually from west to east, and its greatest velocity being at the equator, the equatorial stream of atmosphere (where not interrupted) is drawn after the Earth's surface in the same direction; that is to say, from west to east; but its not keeping pace with the surface, makes the relative current of air, experienced in our tropical regions, to be from the east towards the west. The rapid progress of the Earth's surface to the east at the equator, seems as natural and obvious a cause for producing the general easterly wind, as a flag or streamer, carried swiftly through the air in a calm, would be for producing an effect on the streamer similar and equivalent to a current of the air: but, out of the tropical latitudes, the circles of rotation becoming smaller, and the atmosphere rising in an oblique direction to the plane of the diurnal motion, more and more as the poles are approached, the velocity and force of the rotatory motion is there diminished, and obliquity given to the direction of the superincumbent atmosphere. Accordingly, the motions of the atmosphere have not the like regular and orderly direction near or towards the poles, as in the tropical latitudes.

It is argued that the easterly trade-wind is caused by the temperature, and the alterations to which it is subject, travelling from the east towards the west, occasioned by the Sun passing over the meridians from east to west; and the effect of temperature upon the direction of the winds, is most regularly instanced in the trade-wind being from the northward of east in north latitude, and from the southward of east in south latitude; in the periodical winds called Monsoons; and in the alternate sea and land breezes near coasts of any considerable extent in warm latitudes: and, indeed, in every latitude, the general temperature between midnight and noon, is cooler than the temperature from noon to midnight. Towards sun-rise it is a cooler time than any other part of the 24 hours; and taking equal distances from the meridian over which the Sun is passing, the parts over which the Sun has passed are more heated than those towards which the Sun is travelling, and from which it has been longest absent. If, to restore the equilibrium where the air is rarified by heat, the supply is to come from where the air is most cool and dense, the meridian, where it is early morning, should certainly contribute. The greatest rush should be from the unheated west, to meet the Sun, rather than from the heated east. Noon should travel against the western breeze, and be followed by the eastern.—*Burney.*

By these changes, the different parts of the atmosphere are mixed, cold is subdued by heat, moist air from the sea is mixed with dry air from the land, and the great mass of elastic fluid surrounding the globe, is preserved in a state fit for vegetable and animal life.

In the atmosphere, heated air is constantly rising, and colder air rushes in to supply its place, and this is the principal cause of winds. The air that flows from the poles towards the equator, in consequence of the rotation of the Earth, having less motion than the atmosphere into which it passes, occasions an easterly current. The air passing from the equator towards the poles, having more motion, occasions a southern current.

Winds are varied by the greater heat from the reflection of land, and in particular by large extents of land; also by mountains and by rain, and by the alternate heat and cold of seasons.

Below latitude 30 deg. there is a general tendency of the wind to blow from the east and south-east; and there is always an upper current blowing contrary to the trade-winds. Westerly winds prevail from 30° to 40°.

In hot climates, the wind sets from the sea to the land during the day, and the contrary by night.

Rain seldom occurs in the constant trade-winds.

In the polar regions the winds are more irregular than in lower latitudes.

The west winds are more frequent than the east in Europe. But the west winds diminish more and more in proportion as the centre of the old continent is approached. They are more frequent in England, Holland, and France, than in Denmark, and in the greater part of Germany: and they are more frequent in the last than in Sweden and Russia.

In London, the east winds, (N.E., E., S.E.,) are to the west winds (N.W., W., S.W.) as 1 is to 1·7; at Amsterdam, as 1 to 1·6; at Copenhagen as 1 to 1·5; at Stockholm as 1 to 1·4; at Petersburg as 1 to 1·3.

The west winds blow from the direction of the south point in proportion as the Atlantic Sea is approached: towards the middle of the continent they blow more from the direct west, or from N.W.

The north winds appear to increase as we go eastward.

Miscellaneous Phenomena.

The first notice of *Aurora Borealis*, in England, was on March 6, 1716. Why then, and since, seems inexplicable. No doubt, however, it was one of the natural phenomena by which Priestcraft played on Superstition, and constituted the fiery swords and signs in the heavens, which often led to loss of battles, and revolutions among the Greeks, Romans, and Asiatics.

The Aurora Borealis, though seldom seen in middle Europe, is almost constant in the Arctic and Antarctic regions, covering the whole heavens, and eclipsing, by its splendour, the stars and planets. It is accompanied by a rustling, snapping noise; and, taken altogether, is often terrific.

The height of the Aurora Borealis is undetermined—some say 7, others 100 miles.

At Paris, a late Aurora Borealis varied the needle in declination and dip, but at Woolwich no such effect took place.

In Shetland, the Northern Lights, or "merry dancers," are constant attendants of clear winter evenings. They are also common in all the Arctic regions. When they approach the zenith, they disturb the magnetic needle about 45″. Luminous arches from 1 to 5 are also common, and partly respect the magnetic meridian. They glow and flutter, and seem to ignite some interior vapour. The Autoca is a product of the arches, and flashes from them. These phenomena, likewise, distinguish the Antarctic regions. The colours are various, and often blood-red.

In lat. 74—75, the Aurora was called, by Parry, *Australis*, since it generally appeared southward. It made no noise, and it appeared to be more common from 54 deg. to 60 deg., and more vivid. Franklin, by doubtful observations, determined the height to be 6, 7, and 8 miles. The greatest light was from east to west, and the corruscations darted from south to north. No indication of atmospheric electricity was traced during the winter, and Aurora Australis did not affect the needle.

126 appearances of Aurora Borealis took place in 7 years, at Bruxelles, 47 in spring, and 35 in summer.

Professor Olmsted, of Yale College, has published accounts of 3 great displays of Aurora Borealis, on Nov. 17, 1835, April 22, 1836, and Jan. 25, 1837. Also, clear accounts of the meteors which, for several years, have appeared in the mornings of November. In 1813, with a strong moonlight, he counted 226. At Spring Vale 253 were counted, at New York 300, and at Randolph, Macon College 500. More southward, the numbers were greater.

Sir John Ross, who saw the Aurora Borealis rise between distant objects and his eye, gives it as his opinion, that it is occasioned by the action of the Sun's rays on the vast fields of snow and ice near the poles.

Luminous bands, at vast heights, are often seen stretching from east or west to the zenith and beyond, and about three or four degrees wide. What they are is unknown. Phosphorescent clouds are often seen, but the origin unknown.

Dalton calculates an arch of 100 miles height. The Editor saw an arch, in rolling luminous clouds, from east to west, for above an hour, in 1791, and, judging from its crackling rustling noise, and distinctness, he referred its height to a few miles. Richardson, Biot, Franklin, and Parry, refer them to the region of cirro-stratus. The cause is unknown.

The bright clouds that appear in the night are sometimes very mischievous. One in 1772, at Java, destroyed a district 20 miles round, and killed above 2000 persons, and one in 1757, at Malta, did immense damage. Their origin is unknown.

The *ignis fatuus*, and other such luminous meteors, is the combustion of phosphuretted hydrogen, on its ascension into the air, from putrid and fermenting vegetation or soils. Luminous clouds and the Aurora Borealis are supposed to be of the same nature, the gases in polar regions being evolved by freezing, and burning in contact with hydrogen in the upper atmosphere.

A *water-spout* works like a cork-screw, and moves along like an eddy in agitated water, till its force is scattered, and its contents fall: it commonly begins by involving the bottom of a cloud, which descends in it.

Showers of frogs, fishes, &c. arise from water-spouts, or spiral eddies in the air, from the meeting of contrary currents, by which a vacuum is created, and masses of the waves of the sea, and ponds of water, with their contents, forced to an elevation; and thus, being transported to a distance, and there falling, they produce these strange precipitations.

Capillary action, on which so much labour has been wasted and reason caricatured, is the simple effect of the intercep-

tion of the atmospheric pressure by the glass as to a rarer fluid, and by the mercury as to the rarer glass. The fluid, as most patient of the pressure, rises as to the glass, and the glass, for like reason, rises as to the mercury. In fact, 2 equal tubes, inmercury and water, approximate mean proportionals of depressions, multiplied by the density of each. The effect is increased inversely as the angle which the surface of the fluid within the tube presents to atmospheric pressure, which angle diminishes as the length and the bore. A half-inch bore sinks mercury, or, in other words, mercury raises a tube of glass (which we know would swim on it) the 125th of an inch; a quarter-inch bore the 25th; a 10-inch bore the 7th.

Of all silly and irrelevant proofs of an assumed, but *impossible* principle of action, the lead, or metal, or wood ball experiments of Cavendish, are the most tritely puerile. Bungs and corks, floating with slight resistance on water, display the same principle (that of intercepted atmospheric pressure) in a way most satisfactory to every tyro, while, if loaded, so as to be immersed, they display no mutual action.

The *elastic* force of air raises water, in an exhausted tube, 33 to 35 feet, and quicksilver from 28 to 31 inches, a force equal to 15 lbs. to the square inch, or 2160 lbs. to the square foot.

Viscidity varies the ascent, and also density; but, in general, the diameter of a tube multiplied by the height is a constant quantity. It is this important principle of *intercepted* pressure which occasions a plumb-line to incline towards a mountain, and boats to congregate about a ship, and small corks about a bung; but, if the bung is *as dense as the water*, and floats below the water, the corks are not acted upon.

In a capillary tube, 100th of an inch in diameter, different experimentalists have found water rises in such tube 2, 3, 4, and 5 inches; but, this depends on the length of the tube, because the angle of downward pressure from the top would be inversely as the length, from the fluid to the top. With a tube, 1 25th of an inch diameter, Martin found that spring-water rose 1·2; vinegar, 9·5; milk, 0·8; oil, 0·6; rum and brandy, 0·5; depending, of course, on the viscidness.

Mercury is depressed 0·295 of an inch in a glass tube, the 20th of an inch in diameter; and 0·04 when the 4th of an inch; but only 0·0012 when 8-10th of an inch. It is the reverse of ascent in a fluid lighter than glass, where the air presses its surface more on the outside than the inside. In this case, the exterior mercury presses up the glass, or seeks to do so, which leaves the included column relatively behind.

When a capillary tube is the 50th of an inch, *water* rises in it 2½ inches; when the 100th, 5 inches; and when the 200th, 10 inches.

When two plates of glass are placed at an angle in water it rises 2½ inches, where the plates are the 100th of an inch asunder, and 5 inches where the 200th, or half the heighth which it rises, where the pressure of the air is closed all round, as in a capillary tube. The rise in both cases being entirely owing to the *intercepted pressure* of the atmosphere by the glass, and depending on the angle which the top of the tube forms with the water, being less and less as the bore or angle is diminished.

Water will not rise between cakes of wax or grease, and oil of turpentine rises but one-fourth, but spirits of wine rise two-fifths. Mercury sinks round glass, or any substances lighter than itself, and water sinks when the tubes are made of lighter substances; the experiment, in those cases, being reversed, or at right angles to the former.

Lunar Influence.

Much anxious enquiry has been made as to the alleged connection of the moon with the weather.

Very accurate observations for 20 years, at Viviers, give the mean of the barometer, in *millimetres* of 0·03937, or one 26th, nearly our inch, as under:—

New moon	..	755·48	
First octant	..	755·44	
First quarter	..	755·40	
Second octant	..	754·79	lowest.
Full moon	..	755·30	
3d octant	..	755·69	
3d quarter	..	756·23	highest.
4th octant	..	755·50	
In the peregee	..	754·53	
In the apogee	..	755·73	

At the Paris Observatory,

The quarters give	756·59
The syzygys (new & full)	755·90

The highest and lowest at Viviers differed, it appears, 1·44 millimetre, that is, about one 20th of an inch, and at Paris but one 40th in the quarters and syzygys, almost in insensible quantities.

These small results, deduced from the barometer, are, of course, unerring, and throw doubts on all the vague observations about rain, &c. which fond theorists have stretched over days before and after, to accommodate their fancies. The ærial tides indicate, it appears, in maxima and minima; but the difference of the 20th and 40th of an inch, or only the 600th or 1200th of the whole mean pressure. The cause of the tides (the mechanical re-action of the Earth and Moon) would, no doubt, cause ærial tides in some ratio of the relative density, which is about 830 to 1, and the mean of 600 and 1200, *i. e.* 900 to 1, is in fact, a rough approximation! Nevertheless, as is known to every observer of the barometer, the 20th or 40th of an inch is little indication of change.

These double ærial tides would, of course, act at 9 in the morning, and it appears, by 12 years' observations at Paris, per Arago, that the difference between the barometer at 9 and at noon is 0·35 millimetre, or about the 75 of an inch, but totally different from the previous effect of the phases.

Other assumptions, says Arago, merit notice. After 223 lunations, the Moon's nodes return to the same point, and certain lunar phenomena recur in the next 223, or 19 years, called a Saros, with the exception of those connected with the apogee and perigee, which revolve in only 8 years and 10 months. This discordance changes the tides in their heighths, and, of course, interferes with other effects. In fact, in 1701, the mean heat, at Paris, was 89 deg. 4 min. and the minimum 27 deg. 5 min., and the rain 577; while, in 1739, the heat was 92 deg. 5 min., and the cold 30 deg., and so in 20 instances quoted by Arago; and yet, their assumption of re-currence of weather, as well as general lunar phenomena, is the basis of most of our weather predictions!

Nor does the period of 9 years answer better, for, in a series of terms of 9 years, Arago shews that the rain varies from 262 to 333 inches. The mistake, however, governs the farmers of France, who take leases for 9 years!

The follies of the ancients on these subjects are identical with the follies of astrology Gardeners and farmers have their favourite moons and favourite phases; so, also, physicians and quacks, and madmen called lunatics, in accordance with vulgar superstition! Arago has admirably exposed all these criminal charges against the innocent moon! Its effects are simple action and re-action; and when Arago himself speaks of its attraction, he falls in with the follies which he exposes.

We have now to consider whether the transition from moon to moon produces any change, for all that has been stated refers only to the same moon. The barometer indicates between the last octant and the new moon, but 0·02 millimetre, or the 1300th of an inch, and between the last and first octants of only 0·06, or the 420th of an inch, unless the perigee or apogee interpose its millimetre, so that the alleged changes cannot be caused by the moon, but must be only a coincidence, sometimes observed and mistakenly inferred as a law. By observations at Vienna, it appears that in every 100 phases, there occur 58 changes of weather at new moon, 63 at full moon, and each quarter; so that, if at the time of new moon, there is in course above 1 change of weather, for 2 changes of phases: but, if 2 days be taken instead of 1, then there will be change for change by mere coincidence, not as cause and effect. If taken a day before and after, there will be 3 changes of weather against one of phase, and so on! The observed changes, too, at the full and quarters, are more than at the new. Horsley, in 1774 and 1775, states, in 13 new moons in 1774, there were but 2 changes of weather, and none at the full; and, in 1775, in 12 moons, but 4 changes of weather at the new, and 3 at the full—mere chances.

Balloons.

Wilkins and Luna first suggested ascent in the atmosphere by rarefied air, and Galien, of Avignon, in 1755, wrote a pamphlet on Aerostation.

The first balloon of Stephen and Joseph Montgolfier was a silk bag containing 40 feet, which burning paper raised 70 feet. Their next was a bag of 650 feet, which rose 600 feet. Their third was 35 feet in diameter, and was capable of raising 500 pounds. It ascended before the public June 5, 1783. On the 21st of Nov. Pilatre de Rosier and the Marquis d'Arlandes ascended at Paris, and afterwards others, with air rarefied in the car by heat.

In December, 1783, Messrs. Roberts and Charles ascended in a balloon inflated with hydrogen gas, and after them Blanchard, Morveau, the Duc d'Orleans, and others. In September, 1784, Lunardi made the first human ascent in England. In January, 1785, Blanchard and Jeffries passed from Dovor to Calais, and soon after Rosier and Romain perished in an attempted voyage from Boulogne to England. In Sept. 1802, Garnerin descended from a parachute near London. On the 6th of Sept. 1804, Gay Lussac ascended, at Paris, to the heighth of 23,400 feet.

The superficies of a balloon are computed by multiplying the square of its diameter by 3·1416, or the cubic contents is the cube by 0·5236. Taking atmospheric air at 1·2 oz. to the cubic foot, we have the weight in air; and then, as carburetted hydrogen gas weighs 0·2, the weight of air, multiplied by 0·2, gives the power of ascension.

The air collected by Gay Lussac, at the heighth of 6636 metres, was found to have EXACTLY the same proportion of constituents as on the ground. He made this voyage from Paris to near Rouen, on Sept. 15, 1804, and was 5½ hours in the air, ascending 6977 metres, 23,400 feet, or 4·4 miles, without any inconvenience but from the dryness of the air. Even there he saw clouds considerably above him.

In August, 1807, Garnerin passed 7½ hours of the night in the air, and at 18,000 feet of elevation, in an illuminated balloon, without any personal inconvenience or remarkable phenomena. He saw the sun rise, and in darkness saw little meteors near him. In a second night ascent, in a gale of wind, he was carried above 260 miles in 7½ hours. In another night excursion, Madame Blanchard was 20 hours in the air.

The extraordinary velocity of balloons is to be ascribed to the greater force of uninterrupted air, at great elevations; and, perhaps, somewhat to the velocity of diagonal ascent. The ordinary rate is from 25 to 35 miles, but Sadler went 74 miles an hour; and Green, on one occasion, no less than 98. Green states, after 140 voyages, that from 5000 to 14,000 feet, there is over England a constant N.W. current of 6 miles an hour while S.W. sub-currents move from 30 to 80 In a late voyage of Green, he rose to 19,335 feet when the barometer fell from 30 to 14·7 and thermometer from 66 to 25. But neither he nor his companions *experienced any effect on their respiration.* One current was

60 miles, but his mean rate was 32 miles. At 2000 feet, he passed through clouds of snow.

The Great Vauxhall Balloon is 157 feet in circumference; and the height, when inflated, and the car attached, is 80 feet. It is formed of 2000 yards of crimson and white silk. The method of uniting the gores is by a cement, so tenacious that, when dry, the joint is the strongest part. It contains 70,000 cubic feet of gas. The weight of atmospheric air, sufficient to inflate it, is about 5346 lbs.; and that of the same quantity of pure hydrogen gas, about 364 lbs.; the machine would, consequently, if inflated with that gas, have an ascending power of 4982 lbs.; and allowing 700 lbs. for silk and apparatus, and 362 lbs. for ballast, would be capable of ascending with 28 persons of 140 lbs. each. But, as coal-gas is 6 times less expence than hydrogen, while its specific gravity varies from 340 to 700, or above 8 times that of hydrogen, so the power of ascent is reduced in proportion.

In the ascent of Green's balloon, Sept. 10, 1838:—the balloon, &c. weighed 782 lbs., the ballast 1500 lbs., the 2 æronauts 290 lbs. The power of ascent was 4056 lbs. They proceeded from Vauxhall to Lewes, 45 miles, in 1½ hour, and rose 27,150 feet, or 5 miles 750 feet. The bar. fell from 30·5 to 11, or 10·83 inches, and the ther. from 61 to 5, but the æronauts suffered no difficulty of breathing, and no personal inconvenience, either in this voyage, or in others by Green, of very great elevation.

The ascending power of a balloon with hydrogen gas, to one filled with coal gas, is as 15 to 11 nearly.

Mr. George Pocock, of Bristol, has perfected the application of large kites for rapid travelling by land, for navigation, and other useful purposes. A twelve-foot kite, in a moderate gale of wind, has a force equal to the pull of a man; and, with a brisk gale, to 200 lbs. The force is then as the squares of the lengths; and two kites, one fastened above the other, of 15 and 12 feet, will, in a gale, draw a carriage, and 4 or 5 passengers, nearly 20 miles an hour. An extra line enables the operator to diminish the power by varying the angle of the surface with the horizon, and side-lines enable him to vary its azimuth, and the direction of the pull, nearly at right angles to that of the wind. Mr. P., in 1827, travelled in this way from Bristol to London, distancing every other conveyance on the road. They are made of varnished linen, and so contrived, as to fold into a small space. In addition to the original experiments of Pocock, Captain Dansey has made some decisive ones in proof of the facility of gaining a lee-shore in a stranded vessel. His kite is light canvas, and was constructed with double lines of string, on Pocock's principle.

Meteors and Aerolites.

The records of stones falling in all ages and countries, are at least 300 in number; and recent instances are well-authenticated. They fall by the explosion of a mass, which probably acquires increase of heat as it approaches to the Earth. The most probable theory respecting them is, *that they are independent masses, floating in space, and encountered by the Earth and atmosphere in the annual orbit*; or they may be generated by the condensation of those self-luminous and rustling clouds which often appear single, or in continued chains, and whose origin and nature are at present so little understood. Their condensation may generate these hard substances with a force of projection, and also "the shooting stars." They fall in all latitudes, and, therefore, not from the Moon; and their substance has a crystalline character, regular and sudden, not volcanic.

The meteoric stones which fell at L'Aigle, in France, in 1803, contained

Silica	54
Oxide of iron	36
Magnesia	9
Oxide of nickel	3
Sulphur	2
Lime	1

Specific gravity is 3·4.

One, which fell in Yorkshire, consisted of 75 silica, 48 oxide of iron, 37 magnesia, and 2 oxide of nickel.

A meteor, observed by Halley, was 72 miles high, and its velocity 350 miles per minute. That of 1783, was 90 miles and 1000 miles. Yet they flamed as in a dense atmosphere, with no lack of oxygen.

A meteor as large as the Moon, from the south-east to south, was seen in the western counties of England, on June 29, 1832, at eleven at night. Its light was blinding for a few seconds.

Of the origin and nature of the fiery meteors, which often visit our atmosphere, nothing is known but the fact. The meteor of 1783 was believed to be as large as Great Britain, and 120 miles high, and was seen nearly at the same moment all over Europe.

Aerolites are among the greatest wonders of nature. Above 200 instances are now recorded by Chladni and others, and unrecorded instances must be common. Iron, (malleable and oxide) and nickel, with silica, magnesia, and sulphur, are found in all. In others, alumina and lime, carbon and soda, with manganese, crome, and cobalt, appear. They vary from ½ oz. weight to 300 lbs. and upwards. Silica and iron is their chief component. Among the ancients they were portents and held sacred. Others are found as detached masses of iron and the usual compounds, of vast weight, 1 of 1400 lbs., another of 13 tons, another of 14,000 lbs. &c &c. Red dust, or red snow, also falls, as the apparent explosion of the others from the heat of atmospheric resistance. They are not volcanic, and not formed in the air; we may, therefore, suppose them bodies floating through space, and encountered by the Earth in its orbit. They then get involved in the two-fold motions, fall towards the centre,

and are ignited by their own great velocity through the atmosphere.

Fire-balls and shooting meteors are of the same class, and when they do not fall it is owing to their oblique course. The report they give arises from the collapsing of the air. That they are connected with motions of the Earth, is evident from the same being often visible all over Europe at the same instant. It appears, also, that there is a great concourse of them about the 12th of November, as though the Earth, in Taurus, were passing through a dense stream of them.

On the 12th of November, 1800, between 2 and 3 o'clock in the morning, in the Caraccas, Humboldt saw thousands of fire-balls and falling stars, for four hours, passing from north to south. They were also seen 12 deg. south, and, as he learnt, over Europe, even to Greenland and Labrador, distant 5000 miles.

The same concourse of local atmospheric meteors, 3 or 400 in number, was seen in Middlesex, on November 13, 1838, between 3 and 4 o'clock in the morning. They proceeded from the E. N. E. and N. E. and illumined the atmosphere. Some had trains and others none. Nothing but their number distinguished their appearance from other shooting stars. At that time the Northern Crown and Hercules were in the N. E., and Cancer on the meridian; but such meteors could have no connection with them. Why on that night and at that hour, year after year, is incomprehensible!

Arago and his pupils counted 170 shooting stars on the night of Nov. 12, 1836. 650 were seen at Breslau, in 50 hours, in 1823, in April, May, August, September, and October. At Bruxelles, in 1824, 155 were seen 10½ hours.

There are ancient notices of multitudes of shooting meteors, in August, and the commencement of November.

On October 8, 1827, a shower of aerolites fell near Belostok, between 9 and 10 in the morning. An extraordinary noise, which proceeded from a large black cloud, and continued for 3 or 6 minutes, resembling a running fire of musketry, was succeeded by a shower of stones, of which only 4 were picked up; the largest weighed 4 lbs., the smallest three quarters.

Mr. John Treat states, that, on the night previous to the battle of Brandy-wine, as he was standing sentinel, a shooting star fell within a few yards of him. He instantly went to the spot, and found a gelatinous mass, still sparkling, and he had kept his eye on it from its fall. A lady relates, that, as she was walking in the evening, a similar meteor fell, and the late General Griswold informs us, that a shooting star once fell near him upon a piece of ice, like that of Treat.—*Silliman.*

Shooting stars vary much in heighth; of 130 observed in Germany, 41 were from 35 to 50 English miles; 25, from 25 to 40. Only 5, so low as 5 or 10 miles; and 3 above 200 miles. Of 36, 26 were descending, 9 ascending, and 1 horizontal; or 13 were above 45 or 50 deg.; 22 were between 45 deg. and the horizon; 23 passed the southward, and 11 to northward; 21 westward, and 13 eastward. Their velocity is from 10 to 35 miles per second. Quetelet thinks that definite spaces exhibit 8 per hour, and that simple observers may, in the whole expanse, see 16. They are numerous in the first half of August, and appear as a shoal on the 13th of November.

Berzelius has applied his acknowledged skill to meteoric stones. He concludes they are projections from the Moon or other planets; but he forgets that such projections could only fall near the plane of the equator. Their constituents are anhydrous, and then he refers to the dry moon. The Editor continues of opinion, that they are formations in the medium of space, met or overtaken by the Earth, and that their sphericity, heat, and some of their constituents, arise from falling through the atmosphere. He infers, from their annual appearance, when the Earth is in Taurus, and the Sun in Scorpio, that there are currents of them in space. (If this is not their anhydrous origin, then it is worth while to examine those rocket-like explosions which take place in the western Pyrennees and in the Rocky mountains, which, at indefinite elevations, might produce ranges of 1000 or 1500 miles.) The mean constituents are silica, magnesia, and prot-oxide of iron, forming from 86 to 95 of the mass. The 5 or 6 other constituents are small fractions. The structure of one of 2 lbs., in the possession of the Editor, is in exact radii, and the fracture lustrous. The report which they create is merely the closing of the vacuum after their passage. Their horizontal route, and their ubiquity in such large tracts, as all Europe, exactly accords with what might be expected from a relation with the Earth's orbit motion of 18½ miles per second, so that one would traverse the United Kingdom in 32 or 33 seconds, which accords with observation.

Greater obscurity appertains to many phenomena in meteorology than to other subjects of enquiry, owing to the influence of vulgar superstitions, which on subjects so near and striking interposes miracle for natural causes, and the necessary succession of their effects. Comets and meteors have in all ages been portents, as fiery swords, &c. Thunder and lightning have been the audible and visible Deity. Too much or too little rain, &c. are signs of divine vengeance. Earthquakes, floods, volcanoes, &c. are to be appeased in sack-cloth and ashes,—and many other instances might be added.

LIGHT, AND ITS PHENOMENA.

In treating about Light, we must consider it as a fixed means towards a definite end, and not neglect the final cause. The end is to enable animals to feel beyond the extent of their limbs; and the means are the excitement of the universal medium in which the eye and optic nerves are situated. Any

fancies or mysteries beyond this, merit but secondary consideration.

We find, universally, a convex eye for convergence and increase of action on the nerve, which communicates with the brain. We discover an arrangement of media and forms, which permits concentrated reflections from this outer surface to the retina. And we perceive, that parallel rays fall with different incidence on every part, so that the continuous convexity being parallel to itself, the ray proceeds perpendicularly, and meets the other in a focus common to the whole. This is nature's own adaptation, and it teaches and proscribes our speculations. We have the excited medium, the eye in that medium, and the arrangement to concentrate and multiply the force of the action on the retina, in all eyes of all animated nature; in all which requires feeling or discernment at a distance.

We learn, in infancy, to use the eye just as we do the hands and legs. We have a conventional nomenclature for the shades of its impressions, which we call colours; and we learn to distinguish distances, to discriminate forms, and estimate bulks. All these are acquired powers, as much so as the power of playing the violin with the hands. Beyond light in the abstract, all the rest is art, in which we deal with the most subtle of agencies,—first, that of light, and second, the refined discrimination of the nerves.

The science of optics treats of the excitement and its causes, of the powers, propersies, and accidents of light, and of the instruments by which we analyse it, and aid the eye in performing more than unassisted nature. In all this we must reason as on other subjects. There is no miracle in the operations; and however subtle, nothing, in point of fact, distinct from matter and motion, and their laws.

As the only use of light is to employ the instrument of animal vision, the eye, and as the only use of the eye is to concentrate the delicate momenta of light, so we have, in this *exclusive* fitness of each for the other, the most unquestionable proof of design in one or both, though nature, in many other instances, affords other proofs as conclusive.

Newton supposed light to be a concourse of projectiles, proceeding *from* the luminous body *to* that which is illuminated: but, this was a mistake of the infancy of enquiry, like many other mistakes of that age.

According to Huygens, light consists in the undulations of a highly elastic and subtle fluid pervading all bodies, and propagated round the luminous centre in spherical waves. Each point propagates a series of concentric waves, which intersect one another without confusion. In these undulations, the particles, though in continual motion, are not themselves carried along, but receive only such an impulse as they communicate to others, just as sound is propagated through air. But while each particle in which a luminous wave is propagated, communicates its motion to the next particle in a straight line, it also communicates a portion of its motion to other particles, so as to create a new spherical undulation, of which it is still the general centre; of course also, it assumes that the same medium permeates all bodies, and that their phenomena is their re-action.

Huygens then treats, severally, in a geometrical manner, of the phenomena of Reflection, Inflection, double Refraction, &c.; and, in the main, his theory is now adopted by the most distinguished opticians of the age.

It should never be forgotten, that all light arises from mere combustion or combination of gases. The solar light, in all its properties, so much accords with our lights, that there can be little doubt but the origin of all light is the same.

Light, in general, originates in heat, and heat is the first display, while heat is the motion of the radiation of atoms; and, when stopt, heat is created by the transfer of their momenta. When the intensity and flow increases, the radiation affects the medium of space, or substratum of gases; and it then becomes light, and heat and light mingled.

In our terrestrial lights, we observe the inflammable principle, hydrogen, combined with some form of carbon, and then the excitement or lighting of this mixture, is immediately followed by the fixation of oxygen, and its great heat. The process is accompanied by an extended excitement of the medium in the space, which we call light. The flames of a lamp, candle, coal-gas, &c. are exactly of this description.

Generally speaking, the *colour* varies with the carbon, the degree of *incandescence* with the hydrogen, and the *intensity* with the oxygen. The proportions are definite, for too much or too little of either, renders the result less perfect.

Light-making is, in other words, the union of excited hydrogen and oxygen, for the production of intense heat, and of the subdivision of connected carbon into atoms of all sizes. These are then driven off by the excitement, as the only means of its escape; for if any other conductor is presented, as a metal wire, or even a pin, the excitement thereby escapes, and the flame is lessened or extinguished; and we know well the effect, in this respect, of a long wick. For the time, the flame is a furnace, and the finely-divided carbon receives and represents its great atomic motion, and is its patient. The coarser atoms convey the heat, and the fine, or indefinitely small ones, perform the parts of light, protruding, by their great velocity, all kindred atoms through space. The flame of a candle constantly presents all the prismatic colours, and the flames of oil and carburetted hydrogen are whiter and more intense, because the carbon is better prepared. All the subsequent phenomena are affairs of various re-actions and reflections, by various forms and structures of body.—*Editor.*

If Newton or Huygens had lived after Priestley, they could not have failed to mo

dify their theories as above. In other instances, as well as this, old theories are not modified by new discoveries, till some generations have passed away. Theories, admitted into the monkish establishments and close corporations of universities, have the same tenacity of life as the germ of a toad in a stone.

An *experimentum crucis* is afforded by the iron door of a large furnace. As it heats, the flow of heating atoms is at first large, and may be felt as separate blows on the face within 2 or 3 feet. This proceeds till the excitement of the plate creates subdivision enough for red rays, and the door soon becomes red; but before it becomes red all over, the centre being most excited, and producing greater subdivision, passes rapidly through orange and yellow, while the parts around are either red or dark. The yellow, however, spreads, and by the time the whole is red, the centre is white, with a rude display of all the prismatic colours in different parts, till the centre is glowing white, and the whole acquires a colour approaching to white.

Herschel gave us an *experimentum crucis* when he shewed, that beyond the red breadth there was a dark heating space less refrangible than the red. Forbes and others shew, that the dark space is really a deep invisible red, with most of the usual properties of light.

Melloni, by highly curious experiments, seeks to prove, that light and heat are not the same modification of matter, but the furnace-door explains and answers him. He and others, also, perplex themselves about the undulations of both; but it will be seen, that undulation has no connection with heat.

Sir W. R. Hamilton, M. Cauchy, Professor Powell, M. Fresnel, Professor Lloyd, Sir David Brewster, Dr. Young, M. Fraunhofer, M. Malus, M. Berard, M. Rudberg, Professor Wheatstone, Mr. Talbot, Professor Forbes, and M. Melloni, have been most laborious investigators of light and colours in this age. They generally agree in adopting the theory of Huygens and Young, which ascribes light to a disturbance in waves of an elastic medium that occupies space, and restores its own position as soon as the wave has passed.

The repetitions, or reiterations, of light beget motion or heat on surfaces; and, hence, the heating effects of light by absorption on the surfaces of bodies.

Euler determined the direct light of the Sun to be equal to 6500 candles, a foot distant; that of the Moon, to 1 candle 7½ feet, or 300,000 times less. That of Jupiter, 1 at 1320 feet; and Venus, 1 at 421 feet.

The light of the Sun to Sirius is as 11 or 12 millions to 1, and to the Moon as 800,000.

Herschel thought that the Sun's luminous atmosphere is 2500 miles from its surface.

The principle of the light of the Sun is great gaseous excitement, or atomic motion; and consequent radiation with undulations propagated through space. The motion arrested on any surface is stopt, and reception of it is heat in the body. The best gross representation is the surface of water in a vibrated musical glass.

There is no power *per se* in light, more than in any other agent, and it is subject to action and re-action, like all other matter.

After all, though we may understand many of the accidents and mechanical properties of light, yet its power of conveying the exact images of objects into the focus of a lens, or the eye, even after the light has undergone various accidents of reflection and refraction—that is, the continuing of the object within the pencil, with power to impress it on the retina—is the greatest wonder with which the study of nature renders us acquainted.

In contemplating an incandescent body, we see in this light no vibrations or undulations. All we see is the atomic excitement of certain principles, which create great excitement around in the way of protrusion, expanded, till too diffuse for effect. A taper protrudes its excitement from atom to atom, but does not vibrate an extensive space, nor explode rays which travel 200,000 miles in a second.

The unequalled light produced at voltaic poles, by charcoal points, confirms the idea, that carbon is intimately connected with light. In fact, the same appears in the light of all compounds of hydrogen and carbon—as carburetted hydrogen, &c.

The theory of undulations requires the condition of 458 billions of vibrations in a second of time, and 37,640 undulations in an inch for extreme red rays, and 727 billions and 59,750 for extreme violet. These are inconceivable consequences of the theory.

If, says Young, two equal rays of red light from different sources fall on the same white paper, they will produce a red spot of double the intensity of either, separately, provided their origin be some multiples of 0·0000258th of an inch; but, if the difference of their lengths is equal to one-half the 0·0000258th, and is a multiple by 1·5, 2·5, &c.; then one ray will extinguish the other, and darkness will result. Again, if the differences are one quarter and 1·25, 2·25, &c., then the spot will show but one beam. The same applies to violet in multiples of 0·0000157th of an inch, and to the intermediate colours for other numbers. These, then, are taken to be the length of the waves, or vibrations, of the several colours, like the nodal points of no sound in harmonics.

The intervals or distances of the waves of *red* light from one another, in the succession which they follow one another to produce extreme *red*, are such that there are 37,640 in an inch. Of yellow, 42,580; of green, 47,460; blue, 52,910; extreme violet, 59,750; mixed, or white light waves, 44,440.

Young first promulgated the law, that wherever two portions of the same light arrive by different routes, either exactly, or nearly in the same direction, the light becomes most intense when the difference of the route is any multiple of a certain

length; and least intense, in the intermediate state of the interfering portions, which length is different, for light of different colours. In this respect, light partly resembles the waves of water, when excited by a falling body; and, when waves of different falling bodies interfere, they neutralize, and augment one another, just like those of water or undulations. Two luminous rays may be made to produce darkness.

Fraunhofer determined the breadth of waves of light to be as under, in parts of an inch:—

Red	0·00002582
Orange	0·00002319
Green	0·00002073
Blue............	0·00001912
Indigo	0·00001692
Violet	0·00001572

The intermediate spaces are black, or, when the waves mingle, they are light. In various colours, therefore, no microscope can exhibit an object less than half those measures.

The velocity is equivalent to protrusion, if elasticity be considered, for undulations demand 700 billions of them in a second. An ignited body *protrudes*, displaces, and replaces, according to its magnitude.

Herschel verified these results, and determined that the red rays make 39,180 waves in an inch, and 477 billions in a second; green 47,460 in an inch, and 577 billions in a second; and violet 57,490 in an inch, and 699 billions in a second.

Hence it is inferred, that light is merely the excitement of a medium of atoms universally diffused in space, and not the projection of travelling atoms, as imagined by Newton, whose coloured rings are now ascribed to the interference of waves, vibrations, or oscillations.

The matter of light may, on the contrary, be imagined to be finely-divided carbon in combination with hydrogen, while all the heat, excitement, and radiance is derived from the fixed oxygen. The wavy or pulsative character of its protrusions arise from a returning or re-adjusting stroke. But extended protrusions from every point of an incandescent taper, and the returning stroke of re-adjustment, would be equivalent to a vibration or undulation, and the idea of atomic protrusion accords, therefore, with the theory of undulation.

Light is also an effect of various excitements. Friction produces it, and phosphori produce it; snow, diamond, and the Bologna stone appear to absorb and radiate it; some combinations evolve it, and some plants give flashes. Rubbing the eyes in the dark, and also their inflammation, produce flashes of light. Slacking lime produces light, as well as heat; and crystallization is accompanied by flashes of light.

When the Earth is exactly between Jupiter and the Sun, the eclipses of Jupiter's moons occur 8¼ minutes sooner than the mean time of the tables; but, when the Earth is within half a sign of the Sun, on the opposite side of the orbit, the eclipses are 8¼ minutes earlier. The difference, 16½ minutes, is the time which is spent, while the light is traversing the Earth's orbit. This being about 187 millions of miles, gives nearly 200,000 miles per second for the velocity of light.

This velocity may appear great, but it relates to an infinite last term of matter, and is subject to no obstructions. It is a continuous *protrusion* without lateral friction; and, but for the indefinitely small spaces between the atoms, might have an unlimited velocity. By its means, we see the starry nebulæ, at a million times the Earth's distance from the Sun, so that light is the union of the Universe; and we acquire an additional idea of its wonderful agency, when we consider that the moved atoms so completely fill space on every side, as to render a million of such distant objects visible on every square-inch.

Reflection and Refraction.

Reflection, or rebound, seems to be the only accident of light in connection with other matter. It is an effect analogous to all that we see in other bodies. It is common experience and common sense. Of course, when rays of light impinge on surfaces, their roughness and the comparative coarseness of their particles entangle the rays, and every variety of absorption and reflection results, particular classes of atoms being more absorbed and reflected, according to the surface and its atmosphere. But, if the surfaces and the structures are regular with regular interstices, and the angle of incidence accords, then the atoms of the body permit continued reflections, till the ray issues on the contrary side.

There is no difficulty about light, (dreams and fancies apart) but in the fact that it produces its visual effects through some bodies, and not through others; but this is owing to their own structure, and no affair of light. So, also, surfaces inclined to its course turn it aside; but this is a mere effect of such surfaces.

That the action of the local atmosphere, at the first surface, is the cause of the decomposition into colours, is evident from the natural colours of bodies, produced by reflection from the first surface, when the bodies are opaque and coloured: the chief part of the impinging light is buried, lost, and absorbed, in the pores and inequalities of the surface, and only one colour, or a mixture, is reflected. If the body were transparent, and the sides oblique, like a prism, so as to vary the re-action of the local atmosphere, at going out, we should have the light emerge in all the colours created on the opposite side: but, if parallel sides, then the re-action would balance the first action which generated the colours, and the light would emerge colourless. In passing through we see no colours, because the whole are then mingled by the conflicting reflections.

Easy reflection depends on a direction of the rays nearly parallel to the reflecting

surface; and easy transmission on a direction nearly perpendicular to the receiving surface.

The most difficult problem connected with so delicate an agent as light, is its power of penetrating solid diaphanous bodies. Some suppose the medium of light exists in them, and is affected by vibrations out of them, when the vibrations reach the surface. The difference, however, between opaque and transparent bodies, is in the structure of their own parts. The opaque are irregularly and variously granular; the transparent are regular or chrystalline; and, though the chrystals are varied in form in different bodies, and some give an extra ray, yet they are constant, and descend in size in that form to molicules.

Universally, what is called refraction is merely a modification of reflection.

The deviation from the right line or bending towards the perpendicular, when a ray falls obliquely on glass, or any transparent medium, is an effect of the local atmosphere of the medium, while this is the cause usually assigned, when theory calls in the unnecessary second power of refraction. That it is so, is obvious from the consideration, that if a thin slice of the medium were cut, vertically, at the impinging point, and its edge were employed to intercept rays, it would produce all the phenomena of inflection, by means of that local atmosphere.

Water reflects at 89½° from the perpendicular 721 rays of 1000; at 80°, 333; at 75°, 211; at 66°, 100; at 50°, 34; at 40°, 22; and from 20° to 0°, 18.

Plate-glass at 87½°, 584; at 80°, 412; at 70°, 222; at 60°, 112; at 56°, 85; at 50°, 57; at 40°, 34; and at 20° to 0°, 25.

Window-glass 0°, incidence transmits 0·8737 of the whole light, at ⅞ths. If plate-glass, it was only 0·8027, or 4-5ths.

A plain glass mirror reflects ·5352 of 1000 rays. The quicksilver reflects 2-3ds.

Telescope specula reflect about 2-3ds, but after two reflections, but 9-20ths.

Mercury, at 89½°, reflects 721; at 40°, 704; and at 0, or perpendicular, 2-3ds.

Perpendicular rays, on water, reflect but 18 rays of 1000, and on glass, but 18. At 87½°, or 2½° from the horizontal, water reflects 614, and glass 584. Polish of surfaces renders the local atmosphere of the surface more uniform.

Only 45 of 100 rays reach the eye pure after two reflections by a telescope, and these by the eye-glass are reduced as 100 to 95, or to 42.

Reflection is, in intensity, as difference of refractive power in the media.

Bodies which refract most reflect most, or are more splendid. The local atmosphere which increases one increases the other.

In water, the angle of total reflection is 48 deg. 28 min. In glass, 41 deg. 49 min., for then the sine of the angle of refraction is = to the radius.

The general allumination of a transparent body, is proof that the entire transmission is by reflection, and the principal ray is the condensation of the direct light around its axis.

In every case of reflection whatever, by the angles of incidence and reflection, the pencil is turned round, and its red rays on the right hand become left after the reflection. 90 deg., or right angles, is not essential to this turning of the pencil.

Reflection is, in intensity, as difference of refractive power in the media. Bodies which refract most, reflect most, or are more splendid. These truths imply an identity of reflection and refraction, and, therefore, merit notice. They strongly justify the Editor's suspicion, that all refraction is really but a name for the necessary resultant of modified reflection.

When light is turned by reflection at so sharp an angle as 80 deg., 85 deg., or more, while its velocity is taken to be 195,000 miles per second, we cannot wonder at the heat which it generates; nor at a certain scattering of the atoms, which ends in a polarized ray; nor in a conflict, whether the turned rays should proceed, or not, as Malus describes it.

It follows, that as the second rainbow is the effect of reflection, so must be the first; and we arrive at the result, that all passage of rays through diaphonous bodies is the effect of *Reflection*, to which, by mistake of the cause, the name of Refraction has been given.

It follows, as a corrollary from all known facts, that as the change in doubly-refracting crystals is entirely owing to the inconformable direction of the surfaces of reflection in the second crystal, so refraction is only a variety of reflection. In glass, water, and other uniform bodies, the parts afford a common ray by common reflections, but when the reflecting surfaces, as in certain crystals, can be changed in direction, then we get two rays, and in them a conclusive proof that all refraction is reflection from atom to atom within the substance. The angle of refraction of a body is, therefore, the angle of reflection of the atoms.

The refraction, or deviation of light from its right line towards the perpendicular, is a certain measure on water, greater when salt is added, greater when alcohol is substituted for the water, and still greater when oil is substituted. It increases as substances contain more hydrogen. And, in passing the contrary way, the deviation is an equal measure from the perpendicular.

A ray cannot pass out of water into air at a greater angle of incidence than 48 deg. 36 minutes; nor out of glass into air at a greater angle than 40 deg. 11 minutes. And when within those angles, instead of being refracted, it is reflected.

Refracting planes do not produce colours when the entering and emerging surfaces are parallel. The local atmospheres at each surface then act and re-act equally. But when surfaces are not parallel, and the limits of surfaces actively present different angles, as in the prism, convex lenses, &c. then colours arise

In air and water, when the sine of the angle of incidence with the perpendicular is 1·336, that of the angle of refraction is 1, or as 4 to 3 nearly.

For other bodies, the angle of refraction is as under:—

Diamond	2·439
Glass, 3 lead, 1 flint	2·028
Glass, 2 lead, 1 flint	1·83
Garnet	1·815
Oil of cassia	1·641
Quartz	1·548
Rock-salt	1·557
Amber	1·547
Plate-glass	1·542
Crown-glass	1·534
Castor-oil	1·49
Olive-oil	1·47
Alum	1·457
Fluor spar and sulphuric acid	1·434
Nitric and muriatic acids	1·41
Alcohol	1·372
Water	1·336
Ice	1·309
Ether	1·358
Chlorine	1·000772
Carbonic acid gas	1·000449
Azote	1·0003
Oxygen	1·000272
Hydrogen	1·000138

The inflected, deflected, or refracted angle for every degree of incidence, is then found by dividing the natural sine of the angle of incidence by the number against each substance, and the quotient is the sine of the new direction of the ray in that substance.

But if the passage is from a denser to a rarer medium, then divide the number against each, and multiply the sine of incidence by the quotient. The product is the sine of the enlarged angle.

Thus in water, if the angle of the incidence is 32 deg. is 53 nearly, which, by 1·336, gives 40 for the sine of the inflected or reflected angle, and 40 is the sine of 24 deg., so that the two angles are as 32 to 24, or 4 to 3. Of course we should multiply, instead of dividing, if we had 24 deg. given as the incidence from water to air.—*See* MATHEMATICS *for a table of Sines.*

Atmospheric refractions of the heavenly bodies, for various degrees of altitude, expressing the quantity which is to be deducted from the apparent altitude, bar. 30°, and ther. 50°. It is also 74″ more, when bar. 31° and 8″·1 less, for every deg. of increase in thermometer.

°	′	″	°	′	″
0	33	51	30	1	40
0 5	28	37	35	1	23
1	24	21	40	1	9
2	18	29	44	1	0
3	14	35	50	0	49
4	11	52	60	0	37
5	9	58	70	0	21
10	5	20	80	0	10·2
15	3	34	88	0	2
20	2	39	89	0	1
25	2	4			

The refraction of air to water is as 36 to 34,400.

Horizontal refractions vary from a 7th to an 18th, but Nixon determines the mean at a 15·6 of the angle from the Earth's centre between the objects. Thus, if the distance is 69 miles, it is a degree and 60 minutes, by 15·6 gives 3 min. 85 sec. for their elevation by horizontal refraction.

Inflammable bodies have higher refractive powers; thus, when air is taken as 4530, and water at 7846, hydrogen is 31,000 Fluor spar, in bodies, lowers their refraction.

Carburet of sulphur has the highest refractive power, and in dispersion of colours, or length of speculum, it is superseded only by oil of cassia.

The Prism.

In Newton's prism, the image was at 18½ feet from the hole, 2½ broad, and 10¾ long. Its refracting angle 64 degrees, and the hole ¼ inch. It gave seven colours, but a prism of flint-glass with a hole but the 1-20 inch, at 10 or 12 feet, it is now found gives only four colours, red, yellowish green, blue, and violet. Wollaston and Young concluded that the yellow was a compound of red and green, but Brewster thinks yellow a distinct colour.

Newton called the prismatic colours *seven;* and mistook their proportions, by using only plate or crown-glass, (made of mineral alkali and silex,) whereas flint-glass, (made of oxide of lead and silex,) alters his proportions. No person who repeats the experiment will find more than four or five prominent colours, and the other shades are so intermingled as to defy specification or measure. In fact, it now appears, that every different diaphonous medium has its own law of refrangibility and dispersion.

The colours, in fact, depend on the *size* of the hole; thus Drs. Young, Brewster, and others, find that a hole the 20th of an inch gives but four colours, red 16 parts, light green 23, blue 36, and violet 25 of 100 parts, with a stripe of yellow equal only to 1.

Newton and Frainhofer with a large hole, or ray, and Wollaston with a small one, gave the following degrees for each colour in the spectrum of a glass prism:—

	N.	*F.*	*Wollaston.*
Red	45	56	57·7
Orange	27	27	
Yellow	40	27	82·3
Green	60	46	
Blue	60	48	130·0
Indigo	48	47	90·0
Violet	80	109	
	360	360	350·0

Brewster made the red and yellow, the yellowish and blue, and bluish 120 deg. each. He also found that water alone gives 110 red, 28 yellow, 92 green, 82 blue, and 64 violet. Water and sulphuric acid, 120 red, some yellow, 90 green, 90 blue, and 60 violet.

Oil of cassia, or sulphur, gives 2 parts red, a line of yellow, 3 green, 4 blue, and 3 violet; while sulphuric acid, or water, gives 4 red, a line of yellow, 3 green, 3 blue, and 2 violet. Hence, Newton's proportions and colours

are wrong, and the analogy to the diatonic scale is erroneous.

The yellow is a compound of red and green; and blue a mixture of green and violet; hence there are only *three* primitive colours, RED, GREEN, and VIOLET.—*Brewster.*

As to proportions, the mean ray in crown-glass divides the green and the blue. In flint-glass the mean is much nearer the red. In rock crystal it is much nearer the violet. In oil of cassia much nearer the red than in flint-glass.

Fraunhofer's red results, in 5 prisms, of different substances, were 2503, and his five dispersions were 11,298, about 1 to 4½; but, in flint and crown-glass, the reds were 798, and the dispersions 3860, 1 to 4 837. Violet was wanting in one.

	Red	Other cols.		Dispersion.
Crown-glass	361	1336	=	1697
Flint ditto	437	1726	=	2163
Water	305	1398	=	1703
Oil turpentine, no violet	625	2060	=	2685
Alcohol, ditto	395	1125	=	1520
Sulp. ether, ditto	380	1150	=	1530

He found five colours, but only four in the last bodies; but he discovered that the entire spectrum *was crossed by black lines*, of which he counted 590 from the extreme red to the violet.

Brewster determined that the prismatic experiment of Newton was an illusion. The colours may be changed in character and intensity by media in the prism, and be decomposed by absorption. In fine, he concluded that the true spectrum has equal breadths of *red*, *yellow*, and *blue*. These colours are predominant in every part, and the local colour is merely an excess of it over white light, and over local yellow and blue. After all, the rainbow is the test, and it justifies Newton about seven colours.

Wollaston, with a fine pencil of light, and with his usual accuracy, resolved the spectrum into four colours; red 16, yellowish-green 23, blue 36, and violet 25, in 100.

By extending the length of the prismatic spectrum to 15·5 inches, Fraunhofer so attenuated the light as to discriminate the definite refrangibility of the parts of each colour, by which it left 590 spaces without colour, as black lines or colourless breaks. But Young, by adopting a very small aperture, produced a spectrum which had only seven black lines, or vacant spaces. Brewster since, by extending the spectrum to 17 inches, and further attenuating the light by passing it through an artificial atmosphere of nitrous acid gas, exhibited 2000 lines or breaks in the whole of the colours. It would hence appear, that not only has each colour its specific refrangibility, but *parts* of the same colour have their own definite angle. The effect depends altogether on the diminution of *glare*, for the lines increase when the Sun is in the horizon, and are as the attenuation under all circumstances.

By these points, like lines of longitude, it is found that the refractive powers of all the colours vary in ten different substances.

The greatest light in the spectrum, is between the yellow and green, called 1. In the last half of the red ·021. In the orange ·3. The green 0·328. Indigo 0·185, and violet ·035.

The prism shows colours, because the entering surface is not at the same angle as the emerging surface; and, therefore, the affection on the ray by the local atmosphere of the entering surface, is not balanced by the equal re-action of the local atmosphere at the emerging surface. When the two surfaces are parallel, as in a plate of glass, the actions and re-actions at both surfaces balance, and the ray emerges of the same colour that it enters. But it is evident from this, that it is not the medium which changes the white into coloured light, but the inclined surfaces, or something connected with the surfaces which re-act differently. This something is believed to be the local atmosphere, which varies with the varied constituents of the body.

Polarized light, from a prism of Iceland spar, give the same spectra, proportions, &c. as the ordinary ray.

In experiments of matchless accuracy with eleven different kinds of prisms, Fraunhofer found no less than 590 black lines dividing the spectrum in every case, while the same black lines appear in the fringes by inflection. The indigo and violet have 275 of them, and the yellow 84. The greatest intensity of light was in the yellow, as 1, and the red 0·021, the orange 0·3, the green 0·328, the indigo 0·185, and the violet 0·035. He made seven colours, and in this respect confirmed Newton, but his proportions differ.

The dispersion of the colours is taken at a 27th of the deviation, or refraction, of the mean ray, so that the green being 27, the red is 26·30, and the violet 27·30. But different bodies possess different powers of dispersion, and Brewster has measured above 100. It appears that dispersive and refractive powers have no relation. He makes the dispersive power of flint-glass ·05. Crown-glass ·033. Diamond ·038. Rock salt ·033. Water ·035. Alcohol ·029. Fluor spar ·022. Rock crystal and calcareous spar ·026. Nitric acid ·045. Chromate of lead ·4. Amber ·041. Descending for ·4 to ·022 differing from Newton, who imagined there was but one degree of dispersion.

The dispersive power depends on the substance of which the prism is made. In a prism of flint-glass it is 0·48; of crown 0·33; chromate of lead ·4; oil of cassia ·139; fluor spar and crysolite ·322; water ·335; and sulphuric acid 0·31.

Flint-glass gives the greatest heat beyond the red, and crown-glass just within the red.

There has been much controversy about the coincidence of the proportions in the spectrum, and the Diatonic scale. But, as it is unlikely that there are two sets of co-existing atoms in space, different in kind, and as the dark space beyond the red of the spectrum has been decomposed like the spectrum, we may infer, both from light and

colours, that space is occupied with atoms in sets of sizes, something like octaves. It is, therefore, no objection that a small hole produces but three or four colours, if any hole produces seven, or a division like the Diatonic scale. We might as well infer that, because Apollo's harp had but three strings, therefore, Linus could not produce harmony with seven; and, if so, that the two harmonies were not the same in kind.

As the spectrum varies with the form and substance of the prism, and with the size of the pencil of light, it would be possible to produce a standard spectrum in exact accordance with the Diatonic scale.

Inflection.

Besides Grimaldi's fine experiments on the prism, seven or ten years before Newton, he discovered the *inflection* of light and colours, or the power of local atmospheres; and, also, the *interference* by means of two cones of light, whose edges he made to interfere.

Newton repeated, varied, and improved on all Grimaldi's experiments. The last experimentors on these subjects were Dr. Young, M. Fresnel, and Fraunhofer. In his experiments, Young proved his law of the interference of waves, by which it appeared, that when light with similar waves interfere, they increase the intensity; but when dissimilar waves they produce darkness, not dissimilar to the interferences of tones in music; but he illustrates it by waves of tides, as concurring or not.

A prism resembles a fringe, owing to its oblique side; the light thus comes into contact with the oblique local atmosphere of that side, just as in the case of a wire or edge of a knife; and the spectrum is the product of this local atmosphere. It has been a mistake that the passage through the diaphonous substance of the prism, or the substance itself, had any concern with the colours. The local atmosphere of every body is in effect a prism, or an inflecting edge, if laid obliquely to emerging rays, or if the entering surface is oblique, to the other.

If the Sun's spectrum be admitted through a pin-hole, and a fine wire be placed in the light, the shadow will be *fringed* by coloured stripes intermixed with dark lines. This is ascribed to *interferences*, or nodal points, where the waves concur or destroy one another by contrary motions, according as the distance is a multiple, or otherwise, for each colour.

On the inflection of light, Fraunhofer transcends all others. He placed an heliostal in the aperture, and employed a telescope to view the results. In consequence, from simple inflection, he got breadths of colour like the prism itself from single wires, and varieties most interesting from sets of wires. His apertures varied from the 9th of an inch to the 150th, and even the 900th. He then tried 150 wires, or threads, in an inch, and the results were beautifully-coloured images, in regular formations.

When Newton experimented on the effects of the local atmospheres of bodies which produce reflection without the rays touching the body, he used two knives and brought their edges within the 400th of an inch, and produced three colours at an angle of 12°, with a dark space in the middle. Since that time, Young, Fraunhofer, Brewster, &c. have used fine wires, fine edges, &c. with the most striking results, superseding even the prism. Then, as every reflecting surface may be cut into such edges, we are at no loss to understand reflection, the origin of the deviation of refraction, &c. &c.

Polarization.

Polarization, or division of a pencil of white light into two unconformable pencils, is an accident which the pencil suffers by passing through certain *crystalline* media, or by being reflected from a surface at certain determined angles of transmission and reflection.

The extra ray is composed of light turned by transmission or internal reflection into a new direction, generally at 90° from the direction of the rest of the pencil. Of course, such a change in the *direction* of the velocity, changes all the powers as to the other part of the same pencil. Moving thus in direction across the other, one is reflected where the other penetrates, or it penetrates where the other is deflected, and the visual order of its colours are also reversed. It is, however, still the very same light as the other light, and whichever of them we make the standard, one may be regarded as the polarized ray as much as the other.

The cause is very simple—a crystallised body is made up of minute crystals, whose aggregate constitutes the body. These small crystals lie in juxtaposition at certain regular angles, and they receive and transmit by the mean reflections of their infinitessimals the main ray, but their figure prevails in the larger, and these confer an additional reflection which produces the extra ray.

Reflections of light alternate the direction right into left, and left into right, and reverse the visual phenomena—all promoted by the necessary fixed angle.

We then have polarity by reflection, also at a *fixed* angle, such that, as resultants, the first pencil and the polarized light are, or tend to be, at 90°, in direction *different* from one another. Of course, as in the other case, all the phenomena, &c. are *reversed* in the incident and resulting rays. For, in every case of reflection (as is well-known to every one who looks into a plain mirror) the sides change hands, and though there is not a crossing of rays like a common focus, yet it is a demi-focus in one plane, *sui generis*. Then, at the impinging point, the local atmosphere in its limit of activity decomposes and recomposes part of the light before reflection, just as the whole in refraction, so that we have part in accordance with the usual reaction of reflection, and part as though it were refracted at the fixed angle, which last is the *extra ray* with powers 90° from the reflected part, and

contrary phenomena of colours, transmission, &c.

The curve made by the extra ray in crystals led Huygens to consider the waves or undulations as elliptical, but the consideration that the surfaces of the crystals by reflection produce the same effect when turned round, render this elliptical theory unnecessary. Huygens was not in possession of the theory of Haüy about crystalline structures, and their regular forms and angles.

Malus observed that when light falls on glass, at 35° 35, all, *i. e.* 29 in 1000 rays, are reflected and polarized; the light refracted, consists of polarized light, opposite and proportional, and of the remainder not polarized but direct light. If by proportional he means equal, only 58 in 1000 would be affected. In truth, the only change is the novelty of direction given to these $\frac{29}{1000}$ rays, while as many directed the other way implies mutual reaction at the impinging point.

Crystals, composed of cubes or octahedrons, give no extra ray, owing, no doubt, to the conformity of their surfaces to the plane of the external figure. Iceland spar, a crystallized carbonate of lime, is most characteristic in this respect.

The rainbow is an exact exemplification of the whole system of polarization. The inner bow gives the light and colours of only 1 reflection—but the outer bow gives the light and colours of 2 reflections; and the second reflection directs the emitted light differently from that which produces the colours of the inner bow; and, of course, to the eye this reflection *reverses* the colours. We might then call the light of the second bow *polarized*, lay the 2 sets on each other, interpose a counter crystalline plate, and play various juggling tricks with the light singly and doubly reflected.

When light has been turned into a new direction, by reflection, it is, of course, not reflected at the same angles as other light, moving at right angles to it. Yet, this is the history of the mystery of polarization. Of course, it applies equally to the dark radiations of heat, provided the first division and reflection do not too much attenuate the heat. Polarization is merely an example of the fact, that light and heat may be specially directed. Forbes, by using an apparatus which deducts the 1500th of a degree of heat, readily displayed its polarization, &c.

Polarization is a mere affair of relation and direction among the rays. Thus, rays proceeding one way, are re-acted upon in one way; but, if others are moving in other directions, they, as to the others, produce a contrary effect and order of colours; or, if others are moving at other angles, as is always the fact, we have mixed results.

The effect of reflection is evident, when a ray is passed through bodies, whether crystalline or not. It illumines the whole mass, and disperses part of the ray; and, in a certain thickness, dispersed the whole. Transmission in one spot is, therefore, the united effect in the axis of the principal ray, when there are no crystalline surfaces to give peculiar or extra reflection. But, when there are such surfaces, they produce a direction at 90° from the other, and this has been called polarized. But, that it is nothing but an extra reflection, is evident, from the changes which take place when the crystal is turned round, the effect of which is to vary the angles of the crystalline surfaces to the impinging light.

When modern opticians speak of any light being polarized, they mean, that it is not moving in the same direction as solar light, direct from the Sun; and, therefore, not such light as would be transmitted or refracted along with direct solar light through transparent bodies. Of course, owing to many reflections and deviations of light in impinging upon a planet, there must always be such light moving like cross currents of air or water. Unconformable or unaccordant light would be a more rational name for such light than polarized—a term without analogy.

All light, not in the same direction as the Sun's light, is that light which the spirit of mystication has called polarized.

According to Bouguer and others, at 52 45, the polarizing angle by reflection from *water*, only 40 rays are actually reflected out of 1000: so that Malus's *double* pencil must itself have been very faint, and the polarized portion be reduced almost to a mental creation! Again, on plate-glass, at 54 45, the reflected pencil would be but 77 out of 1000. In every sense, therefore, polarity is "much ado about nothing;" and, at most, is an odd corner of a subject, which philosophy ought not to waste time upon.

Universally, therefore, when a pencil of light has, by reflection and refraction, been divided into two pencils, their subsequent directions of motion render them unconformable to each other, and incapable of producing similar phenomena; and this constitutes the sole cause of what is called polarity.

It developes no new property of light, for polarized light, or the extra ray, when bodies are presented to it in accordance with its novel direction, after a reflection, is in all respects the very same as ordinary light. It is coy as to other crystals, which receive ordinary light till they are turned 90°, in accordance with its direction of motion, while no other proof is necessary of the causes of all the phenomena.

All that polarization has really taught us are as follow:—1. That what we have called refraction is, in all cases, mere reflection from atom to atom, within a transparent body. 2. That the powers of inflection, deflection, or refraction, exist at the surfaces of bodies; and 3. That light, in being reflected through bodies, is subject to the accidents and re-actions of their internal structure.

Thin crystalline plates, exposed to the extra ray, or malus-light from reflection,

called polarized, exhibit various colours, which Biot proves to arise from two regular tints.

By different refractions of the polarized light (as accordant or otherwise, in direction, and in contrast with light in its ordinary direction) the colours and combination change the forms like the kaleidoscope.

Thin plates of mica and topaz produce complimentary colours; like the second rainbow, when lightly passing through the drops, suffers a second reflection. Topaz, also, at different angles, forms elliptical coloured rings.—*Brewster.*

Malus concluded, that all light that had suffered reflection or refraction, contains polarized rays, whose poles have relation to the planes of action on it. He also found, that the rays separated by Iceland Spar, by a second reflection at the other surface, are divided into 4, except when the ray is in the plane of its section. Multiplied and coloured images he ascribed to faults and spaces within the crystal, but Brewster has since proved, that they arise from veins of foreign substances, and that most doubly-refracting crystals have two axes.

Brewster, with great labour, has determined the crystals which have 1, 2, and 3 axes of double refraction, coincident with the crystallographic axes of each.

All these have extra rays, besides the ordinary ray, which is produced by reflection from atom to atom through substances, whose molicules are uniform, like water or annealed glass. The extra ray deviates from the ordinary 6′ 40″, and it falls on the principal section of the crystal, proving that it is the result of the reflections of the crystal.

The polarizing angles of incidence are for air 45°, water 52°·45, glass 56°·45, rock crystal, 57°·22, Iceland spar, 58°·23, chromate of lead 67°·42.—*Brewster.*

When a pencil is polarized by reflection, the sum of the angles of incidence and refraction is 90°; and the reflected ray is 90° from the refracted ray.—*Brewster.*

Every pencil of light is acted upon by the refracting force before it suffers reflection.

Quartz and beryls have peculiar rays, and the phenomena are as various as the angles of the planes which reflect the light in its passage through the crystal.

Heat, imparted to glass, so excites its atoms, as to produce an extra polarized ray.

Colours.

Colours of bodies, for the most part, are determined in the fluid or gaseous state of the body; for then only chemical combinations can take place between the atoms of the body and the colorific corpuscles of light. Bodies, even in a dry state, have gaseous local atmospheres which combine with light. But, in all cases, there is reflection with refraction at the surface, to produce colours.

The expansive character of colours, whether originating in deflection, or proceeding from an object which developes any particular colour, proves that they are attenuated light, and modified impressions of abstract light on the eye. Thus, a pencil of light, but the 20th of an inch in diameter, is spread in colours over a space of 7 or 8 inches by 2 or 3, and we then get colours. Again, each colour evidently arises from the reflection of atoms of various size, beginning with the red, an approximation to heat, making atoms and ending with violet, which approximates blackness or negation.

The colour of bodies is palpably occasioned by the relation, in size, of the atoms of a surface to that of the atoms of the colour; and learning to distinguish them by their conventional name, is an affair of infantine experience.

Meteors produce light in the abstract, not colours, and, also, fixed angles of reflection from atomic surfaces of different atoms; and it is the action on the eye of these atoms at those angles, which create the sense of colours.

Certain imperfections of the optic nerve prevent many persons from discriminating colours. Some see by it 2 or 3, and others confuse one with another, instances of which afford many amusing anecdotes. Hence we infer, that variation of colour is mere variation of mechanical action, and that each variation produces our sense of colours. Green is the centre or medium action, midway between the red and violet, and therefore the most agreeable.

Newton imagined that thin plates of air facilitated the production of colours, and by pressing together two lenses of 14 and 50 feet curvature, he made an ærial space, which increased from 0 to ¼ an inch. He thus got 5 or 6 circular systems of coloured rings, contrasted on both sides from black and white in the centre, to red and blue at the extremities. He calculated the successive thicknesses of the air to be the ⅓ power of the eight strings of an octave. In millionths of an inch, he found the thicknesses in air were 1 for black reflected, and white transmitted; and 9 for the first red reflected, and blue transmitted. In his second series, for violet and white 11 parts, and for red and blue 18. In the third, for purple and green 21, and red and bluish green 29. The other four series were less perfect. It hence appears, that the local atmosphere of glass produces all the colours between the 9 and 29 millionth of an inch, and other colours so long as 3 millionths, and so high at 71 millionths; and a breadth like this is the limit of activity, which produces all the phenomena of the transmission, reflection, and inflection of light.

Brewster, among his numerous valuable experiments on light, has laboriously examined Newton's analogy between the colour of bodies and his thin plates or rings. Newton's example of Green is proved to be a mistake in every instance. Brewster infers, however, with Newton, that the colour of bodies arises from the absorption of some rays of the spectrum, and the reflection of the others.

A round pencil of sun-shine, admitted through a small hole, is expanded by the

oblique surfaces in length, and coloured in shades, so as to appear decomposed. When the surfaces are glass and water, and 7 colours appear, the deflection for red at one end is 1·331, and for violet at the other end is 1·3142. The intermediate colours are orange at 1·3317, yellow 1·3336, green 1·3358, blue 1·3378, and indigo 1·3413.

Each colour is permanent in further applications of it, and the re-union of the whole is white, as at first.

Taking every other one to be a mixture of the shades of the 2 adjoining, the whole are but 3, red, yellow, and blue.

In the prismatic spectrum, violet rays indicate *heat* as 1, green as 4, yellow as 8, and red as 16. Beyond the red, no peculiar action exists. Some philosophers ascribe the colours to this difference of intensity; and, hence, painters call blue cold, green soft, yellow rich, and red warm. Musicians have similar notions.

Stark has found that colours possess different powers of imbibing odours. Thus, black absorbs far more than white, and other colours various degrees.

To exhibit colours from minute reflections, Barton cut grooves in metal from 2 to 10,000 to the inch, which gave beautiful series of colours.

The rays called heating, which Herschel observed without the spectrum, prove now to be very deep red rays.

Delaval concludes, 1. That the colouring particles do not reflect any light. 2. That a medium, or local atmosphere, is diffused over the anterior and further surfaces of the plates, whereby objects are reflected equally and regularly, as in a mirror. 3. All the coloured liquors appear such only by transmitted light; and. 4. These liquors, spread thin upon a white ground, exhibited their respective colours; 5. All coloured bodies, not transparent, consist of a sub-stratum of some white substance, thinly covered with the colouring particles.

Transformations of visual colours are as follow: a square of red, long viewed, produces a light green border, and afterwards a square of light green—

White produces black, and black white
Red, blue .... purple, green
Blue, yellow .... green, red

The accidental colour of any object, is the colour which is *half* the length of the spectrum from the true colour.

A wheel, painted in prismatic proportion, requires 80° violet, 40° indigo, 60° blue, 60° green, 48° yellow, 27° orange, 45° red; and if any colour is taken out, and the wheel turned, the remaining colour is a transformed colour as above. It is ascribed to the subsequent sensibility of the nerves first affected, by which they, as it were, take no cognizance of the same colour, when mixed with others. In general, the new colour is removed *halfway* in the spectrum, as though there were two spectra, one beginning at the middle of the other.

Fraunhofer, in his optical experiments, made a machine in which he could draw 32,900 lines in an inch breadth. There are 7700 veins in an inch of coloured mother-o'-pearl. Iris ornaments, of all colours, are now made by lines on steel, from 2000 to the 10,000th part of an inch.

Chemical Powers of Light.

The most marked chemical effect of solar light is its power of darkening the white muriate of silver; and, if tried in the spectrum, the greatest effect is in the dark part, just beyond the violet; and it diminishes through the indigo and blue till lost in the green. Rays, passed through the coloured glasses from violet to blue, equally darken the muriate: but, through red glass, the change is to red. Artificial lights, and that of the moon, do not produce the changes; but the light of charcoal, at the poles of a voltaic battery, have the effect.

M. Daguerre, a painter of great merit, and inventor of the Diorama, has, by a long course of experiments, reduced to practice the means of fixing the images of objects produced by the Camera Obscura, or Solar Microscope. The means are a skilful modification of nitrate of silver to the surface. It appears that he uses sheets of prepared paper, and that the action of the foci of the pencils of rays produces permanent and very minute delineations. Of course, in moving objects where the foci vibrate, the impression is confused; and it appears, that greens are less determined than red. The moon, as an object in motion, extends its picture; but, the sun and planets may be expected to be well defined. Anatomical subjects, statues, portraits, machinery, and still-life will be as true as nature, and all microscopic subjects be as minute as their images. Talbot and others had conceived the same idea, but the perfection of the discovery is entirely due to M. Daguerre.

Vegetables and animals are affected in constituents and colour, by the absence or presence of light.

These effects, and many others, have led to the conclusion, that the prism and the inflection of wires and edges really decomposes the elements existing in the atmosphere, so that the red is an oxygenous, the green a nitrogenous part, and the violet hydrogenous; while other colours and shades are mixtures, as inclined to either end.

It may, probably, be concluded that the medium, which, when substantially acted on at any point in light, is itself a mixture of those atoms which constitute the elements of oxygen, hydrogen, &c.; hence the protrusion includes all these; then, in them we have the colours; and also the different refrangibility, as it is called, when they fall on an oblique surface. The different colours of very remote stars prove that the causes of colour are universal.

In shop-windows, muriates of soda give *yellow*—of potash, *violet*—of lime, deep *red*

—of strontia, *crimson*—of lithia, *red*—of baryta, *apple-green*—of copper, *green*.

Late experiments of Ellis and others prove, that the green colour of plants arises from the nitrogen character, that red colours arise from oxygen, and indigo and violet from hydrogen

Cameleon mineral, made from potash and oxide of manganese, when dissolved in warm water, changes to green, blue, and purple. Oil of almonds with soap and sulphuric acid is yellow, orange, red, and violet.

Such is the power of colour upon matter, that one grain of blue vitriol, or carmine, tinges an entire gallon of water.

Herschel ascertained that the extreme heat of the spectrum was $1\frac{1}{2}$ inch beyond the red end, but others say at the red end.

Ritter and Wollaston found that the violet end, and beyond, blackened muriate of silver; and, a little beyond, and when blackened at the end, it was restored at the red end.

Phosphorus emits white fumes in the red, which are arrested in the violet.

Morichini magnetized needles in the violet rays.

Wollaston proved the deoxydating power of the violet end, and the oxydating of the red.

Messenni described the reflecting telescope, 1839.

The intensity of light is in the red 2, in the orange 30, in the yellow and green 100, in the blue 32, in the indigo 18, and violet 3.

The heating atoms of light are less refrangible than red rays, and this is a key to many of their phenomena.

All metallic oxides, especially those of mercury, lead, silver, and gold, become of a deeper colour by exposure to the Sun's rays. Green precipitate, from a solution of iron, exposed to the rays of the Sun, becomes blue; and words written with a colourless solution of nitrate of silver, become quite *black* when exposed to the light.

The invisible violet turns guaiacum to green, which the red rays restore.

Many flowers follow the Sun's course, and plants reared in houses extend themselves towards the light. Plants that grow in the shade, or in darkness, are pale, and without colour; and, the more plants are exposed to the light, the more colour they acquire.

The effect of light, in promoting intermixture and explosions, as well as many chemical phenomena, is complete evidence of its atomic action, and of its similarity to all other atomic phenomena.

The change of colours, in mixing fluids, arises from changes of bulk and density in the atoms.

Coloured flames resemble the solar spectrum, when viewed through coloured glasses.

The flame of oil-lamps contains rays not in the solar light.

Crown and plate-glass make the greatest heat in the red, flint beyond, and water and alcohol in the yellow.

The *heating* power of the red rays in the spectrum, to green is 55 to 26, and to violet 55 to 16.

Many salts will crystallize only when exposed to the light; and some bodies, if exposed to light, combine with it, and, under certain circumstances, emit it again.

Black has small atoms, and absorbs light—white large, and reflects it Reds are of oxygen character, according to Ellis; greens nitrogen, and violets hydrogen. Their minute parts decompose incident light, and absorb some and reflect others. An oxygen body combines with hydrogen, and reflects red, and the contrary with others. Thus, a hydrogen atmosphere absorbs red, &c. and reflects blue, indigo, &c.; and a nitrogen absorbs red and violet, and reflects green, or white, orange or blue.

Wollaston's prismatic proportions give exactly the atmospheric proportions of oxygen and nitrogen. Taking the red as oxygen, and the blue and violet as nitrogen, we have 16 to 61, to 1 to $3\frac{13}{16}$ for the yellowish green, which, added to the 16, is $19\frac{13}{16}$ and $80\frac{3}{16}$. In like manner, the violet end might be taken as hydrogen, and $2\frac{1}{5}$ taken from the blue, would make the spectrum $19\frac{13}{16}$ oxygen, $52\frac{12}{16}$ nitrogen, and $107\frac{7}{16}$ hydrogen.

Rock salt entirely obstructs the passage of the heat in a pencil of rays, and light passed through it does not affect the most sensible thermometer.

Light hinders germination in mature seeds, with sufficient heat, moisture, and air.

The Eye.

In the human eye, Young made the optical axis 91—100th of an inch. Aperture of the pupil from 27 to 13—100th. Radii of the two surfaces of the crystalline lens 30 and 22. Focal distance of the lens 1·73 inch. Visual range of the eye 110°.

The spherical aberration of the crystalline is corrected by increased density at the centre.

The crystalline lens in the HUMAN EYE is composed of thin laminæ. At 25, the edges begin to be yellow, and at 80, the whole is like amber. The optic nerve enters the eye ·11 of an inch from the axis of the eye on the nasal side. The axis is ·91. The pupil varies with light, from ·13 to ·27. Focus of the cornea and chrystalline, ·69. Angle of vision, taken in by the fixed eye, 110°.

The diameter of a female crystalline, taken by Dr. Brewster, 0·378; thickness 0·172, refractive power 1·384. Refractive vitreous humour 1·34, aqueous 1·336.

The following are other dimensions of the parts of the human eye, in inches:

Diameter, from the cornea to the choroides	0·[illegible]5
Radius of the cornea	0·335
Distance of the cornea, from the first surface of the crystalline	0·106
Radius of the first surface of the crystalline	0·331
Radius of the back surface of the crystalline	0·25
Thickness of the crystalline	0·273

A good eye can see distinctly at the distance of 6 or 7 inches.

The smallest visual angle is half a minute, or 30 seconds, and its size on the retina the 8000th of an inch.

The eye detects differences in light up to a 66th.

Both eyes make an object 1-13th brighter than 1 eye.

Objects are single to both eyes, because each eye refers them to the very same place.

Plateau determined the time during which the impression of luminous rays upon the eyes remains; and has given the following results in fractions of a second:

Flame................	0·242
Ignited charcoal	0·229
White	0·182
Blue	0·186
Yellow	0·173
Red	0·184

The effect of light on the eye continues 8-3ds, or the 450th of a minute.

If an object be more distant from either of two stations than 100,000 times the base, the angle at one station being 90°, that at the other will be 89° 59′ 57″ 9, the difference of which, and 90°, being but 2″ 1, is too small for sensible observation. Thus it is with the Earth's orbit at the fixed stars.

If the eye were microscopic, we could not see prospects.

Harris thinks the least angle for any object is about 40 seconds; and at a mean of eyes not less than 2 minutes. To most eyes, the nearest distinct vision is about 7 or 8 inches. Taking 8 inches for that distance, and 2 minutes for the least visible angle, a globular object of less than the 300th part of an inch would not be seen.

An object in motion will appear to be at rest, when its motion in a second is to its distance as 1 to 1400.

The variation of the pupil adjusts the eye to near and remote objects; and the most perfect vision is from those rays that pass nearest the axis of the pupil, and pass straight to the retina, without refraction.

The blind youth, who was couched by Chesselden in his thirteenth year, thought scarlet the most beautiful of all colours; but black was painful. He fancied every object touched him. He could not distinguish, by sight, objects which he knew by feeling; and was some time learning to distinguish, by his new sense, between the cat and the dog. Those things which he had liked best were not equally agreeable to his sight; and he had to learn, by sight, the name of every thing he saw.

Sir Everard Home couched some young persons with results exactly similar to those of Chesselden. They could not tell the name of any object till they were told what it was, or till they felt it, and had no idea of distances.

The blind make up for defect of sight by the accuracy and sensibility of their touch, and by habits of association between the touch, memory, and judgment. Stanley, the organist, and many blind musicians, have been the best performers of their time; and the blind discriminate sounds at a distance with infinitely greater precision than persons who depend on their visual organs. Miss Chambers, a schoolmistress at Nottingham, could discern that two boys were playing in a distant part of the room, instead o studying their books, though a person who saw them, and made no use of his ears, could not perceive that they made the smallest noise; and in this way she kept a most orderly school. So Professor Sanderson could, in a few moments, tell how many persons were in a mixed company, and presently discriminate their sexes by the mere rustling of their clothes. Stanley, and other blind persons, played at cards by delicately pricking them with a pin. A French lady could dance in figure-dances, sew tambour, and thread her needle. The ear, too, guides as to distance, by reflection of sound, and within these few years a blind man, from his infancy, was a surveyor and planner of roads in Derbyshire. When a sense is wanted, the others are cultivated with care.

Some blind persons say they can discriminate colours: others deny the power. Miss M'Evoy, of Liverpool, could read, says Dr. Renwick, by laying glass over a book, and distinguish objects in the street, by feeling on the glass of the window.

The late blind Justice Fielding walked in my room, for the first time, when he once visited me, and, after speaking a few words, said, "This room is about 22 feet long, 18 wide, and 12 high;" all which he guessed with accuracy by the ear.—*Darwin.*

Brewster shews, that the spheroidal lenses of fishes and birds are composed of cores, like meridianal lines on a globe, united at the surface by teeth. At the equator there are 2500 fibres, and 12,500 teeth to each, while the fibres in the lens are 5 millions; the radius of the lens is 2-10ths of an inch. Some vary in form and structure.

An *oxy-oil lamp* has been invented by GURNEY, with nearly the same intensity of light as the oxy-hydrogen lamp, and with actual economy in the consumption of oil. It is said to be equal to 20, 30, or even 50 argand lamps, and therefore admirably adapted to maritime and street purposes, and for the illumination of roads and parish steeples. It is a further proof of these theories.

Visual Phenomena.

Twilight ends and begins when the Sun is 106 degrees from the zenith, usually called 108 degrees, or 18 degrees after sun-set.

Of 10,000 rays of light, only 8123 reach the Earth when the Sun is vertical. 8,000 at 70° high; 7624, at 50°; 7237, at 40°; 5474, at 20°; 3149, at 10°; 1201, at 5°; and 47 at 1°.

In the inner rainbow the emergent ray will be the mean of the most or least refrangible, or $\frac{42{\cdot}2 + 40{\cdot}17}{2} = 41° 95′$ — the dispersion or breadth being 1° 45′, after two refractions and one reflection, the re-

emerging uppermost, and the violet lowest. In the outer bow the ray will emerge at

$$\frac{50\ 59 + 54\ 9}{2} = 52^\circ\ 34',$$ the dispersion or breadth being 3° 10', but suffering two refractions and two reflections — the extra reflection will reverse the colours or image just like all mirrors when rays are turned by them in the same plane. The line of Sun's direct rays are the centre of the bow; hence, when the Sun is above 42° 2' high, the inner bow cannot be seen, and when it exceeds 54° 9', the outer bow is invisible. In the inner bow we get all the colours in Newton's spectrum, violet to red, and in the other, all from red to violet, a reasonable justification of his classification of colours. In fact, a prism and aperture, which gave exactly the same subdivision, might be deemed *standard*.

The angle of the inner bow, per Potter, is 42 deg. 18 min., and that of the extreme red of the secondary bow is 50 deg. 20 min.

Supernumerary bows, within the inner bow of red and green, seem to be generated by another octave of atoms, (so to speak) which are reflected at less angles. In this case, the primary bow gives seven colours, and is that standard which is demanded in our experiments.

Halos and parhelia are caused also by the refraction of crystals of snow at angles of 22° and 46° from the Sun or Moon, which 22° exactly correspond with prisms of ice at 60°; and the external circle is the effect of two refractions.

By interposing a crystal, so as by its reflections (or refractions) to bring the colours of one bow on the other, we should produce, of course, all the metamorphic light of the various polaritizy apparatus.

When the Sun, &c. are in the horizon, the light has to pass an horizontal length through the atmosphere, and the smaller rays of violet and blue being absorbed, the objects appear red, orange, and yellow. So, likewise, in deep water, the day light appears red because other rays are absorbed. It often happens also, that when the horizon is red, the atmosphere about it reflects orange, yellow, green, &c., each more refrangible than the other.

Biot says, that 5° of Fahrenheit difference will produce a mirage over a smooth surface, and he ascribes them to a curve of light which renders objects simple, double, or inverted.

Phenomena of unequal refraction, as elevated coasts, reversed ships, fata morgana, mirage, loaming, &c. arise from unequal refractions in strata of air of unequal density, as has been proved by fluids in bottles. Reflection from mists and dense strata also produce striking appearances.

Coronas, or halos, round the Sun, Moon, Stars, or even a terrestrial light, especially in fog or vapour, like the rainbow, are reflections, or reflections and refractions from the vesicles which compose vapour; and, as all those at equal angles give the same colour, so they appear in coloured circles. Their size depends on the intensity of the light, and the density of the vapour, sometimes but 3° or 4°, and, at others, from 30° to 90°. When made by frozen particles, their colours are very vivid. Their frequency proves that aqueous vapour abounds in the lower atmosphere, about 44 miles high.

The apparent distance of the horizon is three or four times greater than the zenith. Hence, the mental mistake of horizontal size, for the angular dimensions, are equal. The first 5 deg. is apparently to the eye equal to 10 or 15, at 50 or 60 deg. of elevation, and the first 15 deg. fill a space to the eye equal to a third of the quadrant. This is evidently owing to *the habit of sight*, for, with an accurate instrument, the measure of 5 deg. near the horizon is equal to 5 deg. in the zenith, and if the angle of the Sun or Moon be taken, either with a tube or micrometer, when they appear to the eye so large in the horizon, the measure is identical when they are in the meridian, and appear to the eye and mind to be but half the size.

Taking the light of the Moon at 66° high to be 1000, at 20° it is 666, and in the horizon but 1.

Optical Instruments.

The principle of magnifying power, effected by convex and concave crystal surfaces, arise from the indefinite multiplication of images, by surfaces at different angles. A lens with three surfaces of 60° gives three images, one with 180 of 1° each, 180 figures, scarcely separable; but one with 10,800 surfaces, of 1 one-minute each, gives 10,800 images, still less separable. When, however, the curved form is given, and the sides become infinite, the images are infinite; and, being no longer separable, are seen as one image under one enlarged angle. —*Phillips.*

Dollond's discovery of the achromatic lens of crown-glass and flint-glass was not accidental; but the result of a long series of experiments begun with a view to sustain Newton's error about equal refrangibility and dispersion, which had been disputed by Euler. It was an English manufacture till the French began also to make flint-glass.

In *Achromatic* telescopes, the colours of refraction, through any single glass, are corrected by combining glass lenses of different dispersive powers, as crown-glass and flint-glass. They were first made by More Hall, about 1723, and for sale by Dollond in 1757. The object-glass is composed of two convex lenses of crown-glass, and one concave of flint-glass; or sometimes of one of each. The curvature, to be multiplied by the focal length of the whole, should be as follows:—

1st lens, convex crown 0·6087 ....0·8696
2d lens, concave flint..0·4544.........0·6087
3d lens, convex crown 0·6087.........0·6087

With two glasses—

1st lens, convex crown 0·293........0·353
2d lens, concave flint.. 0·345........1·148

or, for 30 inches, 8 inches and 14·3 for the

first; and 12 11 and 28·5 for the second lens, taking the specific gravity of the flint-glass at 3·354, and the ratio of refraction in the two, as 1 to 1·656 In eye-glasses, the concave should be crown and the convex flint; the first 0 64, the second 0·529, and the third 0·64, multiplied by the focal length: and, in double eye-glasses, 0·32 and 0 529.

Taking the dispersive power, or prismatic spectrum, of crown-glass at 1, that of flint-glass with lead 3, is 4 8; with lead 2 is 3 5; with lead equal 3 26; and with half is 1 8. The index refraction varies from 2·028 to 1·7.

A colourless telescope of a foot is a crown-glass convex lens of 4·33 focus, with a concave one of flint-glass of 7·66, with eye-glasses of 2 inches.

An achromatic object lens should have the radii of the crown or outer glass lens, as 6 75 and 4·28, and of the flint as 14·4 and 3 39, giving a focal length of 10, and the refractive indexes being 1·524 and 1 585.

One eye-glass transmits 0·9; 2, 0·9; 3, 0 85.—*Herschel.*

Mr Barlow has made an instrument with a plate-glass object-glass, and corrected the colours, by interposing a lens filled with sulphuret of carbon, whose refraction is that of flint-glass, while it is perfectly tranparent. The second lens, of course, enlarges the angle, and increases the magnifying power. A 7·66 feet instrument, therefore, magnifies 700 times, but with less light than Sir James South's. Rogers has proposed to interpose flint-glass of smaller size.

Barlow's telescope has a 7·8 inch object crown-glass, with focus 6·5 feet. At 40 inches is a concave lens, to correct the different refrangibility of fluid sulphuret of carbon, focus 6 feet, which at the same time extends the first focus to 12 feet. It bears a power of 700, and up to 300 shows no colour.

The great difficulty in improving telescopes has been the manufacture of flint-glass lenses of sufficient size.

Fraunhofer made two object-glasses, 9·9 and 12 inches. The 9·9 is in the 25-feet telescope at Dorpat. Its powers are from 175 to 700. Sir James South has two French object-glasses, 12 and 13 inches diameter.

A reflector of 24 feet focus requires a speculum of 24 inches diameter, and with an eye-glass of 0 28 magnifies 1000 times. One of 12 feet, 14·5 inches, an eye-glass 0·24, 600 times. A 6-foot 8 6, an eye glass 0·2, 360 times. Herschel used eye-glasses 0·02 focus.

Herschel's 40-foot is in Newton's form, with a tube of sheet-iron. The eye-glasses, with which it magnifies 6400 times, are one-fiftieth of an inch focus. The great speculum was 48 inches diameter, 3½ inches thick, and 2118 lbs. weight, and it magnified 6400 times. His discoveries were, however, made with five-feet achromatics, and his great telescope was a toy: the mirror would not keep its figure.

The speculums of reflecting telescopes are 32 copper, 15 grain tin, 1 arsenic, 1 brass, and 1 silver.

The Cassigram telescope has its small speculum convex. The Gregorian concave. The Newtonian flat, and placed at 45°, reflecting the image to an eye-glass in the side; but the loss of light is 45 in the 100. Brewster proposes to substitute an achromatic prism of crown and flint-glass, so as to *refract* the image to the eye-glass in the side.

The Cassigram gives more light than the Gregorian, as 7 to 3, and magnifies as 1 5 to 1. A 3-feet Gregorian will magnify 40 times, and a 5-feet 85 times, a 12-foot from 300 to 1200.

The Cassigram telescope is superior to the Gregorian, as 20 to 11, and its illuminating power as 5 to 2.—*Kater.*

Sir J. Herschel's telescope is 20-feet focus, with an 18-inch speculum. The Greenwich telescope is 25-feet, and 15-inch speculum.

Night-glasses, called space-penetrating, have larger object-glasses.

The magnifying power of a telescope is the quotient of the focal length of the object-glass, by the eye-glass, or one of the eye-glasses. Priestley says, the easiest method to find the magnifying power of any telescope is to observe the distance you can read a book with the naked eye: removing it to the farthest distance at which you can distinctly read it by the telescope; and, the greater distance, divided by the less, gives the power of the telescope.

A common refractor of 4-feet magnifies in line 40 times, of 10-feet 63 times. A 30-feet requires an object glass, with an eye-glass of 3·3, and magnifies 109 times.

As the size of every object is the angle which its diameter subtends, so the true power of a microscope or telescope is the increase of that line; but, to augment the wonder, many square the line for the superfices, and others cube it for the solid. Thus a power of 20 is often called 400 or 8000.

The aberration of glasses, from spherical figures, is in a plane convex 4½ times its thickness. A convex lens, whose sides are 1 and 6, is 1·08 its thickness. An equal double lens is 1 57 its thickness. The best form of a *lens* is a double convex, whose radii are 1 and 6

Spherical aberration is avoided by an ellipsoid lens, whose greater axis is the index of refraction, and the distance of the foci 1.

The aberration of an eye is 4·2, with the plane side first, and only 1·081 with concave or convex surface first. Double convex or concave is 1·5672, plane-convex reduces it to 0 6.

The spherical aberration is to that from colour as 1 to 1200.

The surface of a true concave mirror is a paraboloid. In reflecting-telescopes the mirror is an ellipsoid.

Burning Mirrors.

One of the most curious speculations is that of concentrating, or multiplying the heat of the Sun, by plain mirrors, concave mirrors, or convex lenses. As one plain

mirror reflects the heat of the Sun, so the reflection of two, three, or more, augments the heat. In this way, Archimedes burnt be Roman fleet at Syracuse and Antheonius, an architect at Constantinople, described the method, and so does Leonard Digges, who wrote on it in the reign of Elizabeth, and asserts that he fired bodies half a mile distant. Burning mirrors and lenses are also noticed by the Greeks.

Buffon combined plane glass-mirrors only 6 inches by 8; and, with 40, set on fire a tarred beech-plank 66 feet distant. With 98 at 126 feet; with 112 at 138 feet; with 154 at 150 feet; with 168 at 200 feet; and he melted all the metals at 30 or 40 feet.

Concave burning-mirrors have been made of great size and power. They concentrate the Sun's image at half the focal length. One of 4-feet diameter, made of copper and tin, melted iron ore in 24 seconds, a sixpence in 7½ seconds, a halfpenny in 20 seconds, tin in 3 seconds, cast-iron in 16 seconds, and slate in 3 seconds. Water boils immediately and evaporates, wood flames in a moment, pummice-stone becomes glass, earth yellow or green glass.

Concave wood or pasteboard, gilt and polished, makes as good a focus as metal.

Parker made a glass lens 3 feet in diameter, with 6 feet 8 inches focus, and 3½ inches thick at the centre. It fused slate in 2 seconds, pure gold, platina, nickel, and cast-iron, in 3 seconds, pure silver in 4 seconds, pebble, barytes, and lava, in 7 seconds, steel and bar-iron in 12 seconds, limestone in 55 seconds, volcanic clay, Cornish moor-stone, and rhomboidal spar, in a minute.

Gold retained its metallic state though exposed for hours. Wedgwood's pyrometrical clay ran into white enamel in a few seconds. The lunar rays gave no heat.

The rays were concentrated about 4000 times, if the focus was the quarter of an inch in diameter.

Trudaine made another, which in the focus, 11 feet, melted steel in 5 minutes, and silver coins in a few seconds.

To find the focus of a concave mirror, multiply the distance of the object by the radius, and divide by twice the distance added to the radius. In parallel rays, or infinite distance, it is half the radius. The size of the image is inversely as the two distances.

A concave mirror makes a focus of cold from ice, but the focus is negation, like its source, and there is no cold *per se* more than heat *per se*.

Young's *Eriometer* is an application of those coloured rings which appear on glass covered with vapour or dust, when applied to a candle. He found the seeds of lycopodium were the 8500th of an inch, and also 3½ on his inch scale of coloured rings, and this he makes his standard, *viz.* the 30,000th of an inch. In parts then of 30,000ths of an inch, he found the atoms of milk 3, or the 10,000 of an inch; of bullock's blood 4½, or the 6666th of an inch; human blood 3750th; silk 2500th; beaver wool (jointed) 2400th; mole's fur 1850th: goats wool and cotton the 1600th; Saxony wool 1500th; Spanish wool 1200; South Down wool 1000th; coarse long wool 500th of an inch in diameter.

Impressions on the eye are permanently continuous, which are repeated *seven times* in a second. On this is founded the toy called the *Thaumatrope*.

The *Photometer* determines the quantity of sun-shine, at noon, to be from 90° to 100° at mid-summer, and in mid-winter 25° to 28°. A northern aspect at noon, in summer, is from 30° to 40°; and in winter from 10° to 15° In gloomy summer weather it is from 10° to 15°, and in winter only 1°.

A multiplying-glass is merely a transparent substance, with several plane surfaces towards the object. 10 sides give 10 images up as many angles. 1000 give 1000; and an infinitely-sided glass (as a lens) gives an infinite number, seen then as one in an enlarged angle; and this is *the fundamental principle of the magnifying power of all circular or curved surfaces.* Colour arises as in the prism from the inclined sides, and aberration from figure from the varied refractions at the angles of the planes.—*Editor.*

The *Camera Lucida* is a contrivance by which, in drawing, the reflection and transparency of a plate of glass are made available. On this principle, the objects in the field of a telescope may be so projected from the eye-glass as to be readily drawn.

The magic lantern and phantasmagoria is the same thing; the slides in the last being opaque, except where the figures appear.

Spectacles enlarge the field which are concave towards the eye, and convex to the object; the concavity or convexity being varied.

A sphere of plate-glass gives a focus at half the radius beyond the sphere. One of diamond is half the focus, half way within the sphere, and one of sapphire carries it to the opposite surface.

A plano-convex lens has the greatest field of view; double and equal convex the least; the side of least convexity should be nearest the object.

A convex lens has its focus in the radius, or mean of two; a plane convex twice the radius. Concave is the same.

The aberration from figure of a plano-convex lens, is, with plane side to the object, 4·5 its thickness, and with convex side, is but 1·17. The lens of least aberration is convex 1 to 6, the 1 outwards.

A plain mirror half the size reflects the whole superfices, the angle being doubled by the reflection.

Only 45 of 100 rays reach the eye after 2 reflections.

Mirrors are silvered by mercury, heated with half the weight of tin.

Concave mirrors present an image just as it would be seen before the mirror at half its radius, but reversed. On the contrary, convex mirrors present upright images, just as they would be seen in the imaginary focus of the rays from behind. The reason is this, all the rays fall on tangents of the con-

vexity or concavity, and these tangents are oblique to the perpendicular ray, so as to give to each ray a different angle of incidence, according to the curvature of the surface.

Microscopes are made with specula of 0·3 inch focus and aperture. They are used by the observer on his back, with light through a small aperture.

Garnet, ruby, sapphire, and diamond, constitute the best lenses for single microscopes, with focal length the 30th or 50th of an inch.—*Goring*.

The microscope detects globules with important functions in the blood, the chyme, the chyle, the lymph, the milk, the pus, &c. It also displays globules equally active in vegetable organs. Animation appears to begin with a globule, called the *monas termo*, a transparent point visible with the microscope, and found among infusorii.

The best compound microscopes magnify the diameter from 4 to 500 times. The mathematical power is directly as the distance of the image from the object lines into the distance of distinct vision by the naked eye; and inversely as distance of the object from the object glass into the focal length of the eye-glass. When a lens is introduced, to enlarge the field, the power is diminished.

The best microscopes have 2 plano-convex lenses with their plane sides next the object, and at a distance equal to the difference of their focal lengths.—*Pritchard*.

A microscope, like a telescope, has a defining power, when free from aberrations of colour and figure; and a penetrating power when it has a large angle of aperture.

Object-glasses in microscopes admit 68° of light, free from colour or aberration.

A microscope of 300 linear power, is best adapted to view the 300 species of infusoria discovered by Ehrenberg.

Lenses of jewels require less convexity than glass, and therefore give less aberration from figure. They also disperse less than glass. The curvature of glass to sapphire is as 5 to 3.

The hydro-oxygen microscope, with light from a pea of lime, is one of the greatest modern improvements.

A ball of lime ignited affords a very strong light, equal, in the focus of a mirror, to numerous argand lamps. Marble, at 750°, gives a brilliant white light. The most intense known light is that produced by galvanic poles, under an exhausted receiver, where nothing but oxygen and hydrogen are present.

An ignited pea of lime has also been used in light-houses, when only 3·8th of an inch in diameter, yet its light is equal to 13 argand lamps, or 120 wax-candles. With a reflector, it casts a shadow at 10 miles' distance.

If the pea of lime is turned during its illumination by the flame of the hydro-oxygen current, it will last for 3 or 4 hours.

Ehrenberg discovers with the microscope, in soft earths, &c., that chalk consists of small elliptical bodies formed of concentric articulated rings, and are in size from the 2500th to the 6000th of an inch; that calcareous incrustations consist of small articulated needles, with a tendency to a spiral; that porcelain, earth, or kaolin, is composed of round bodies the 400th of an inch that mixed earths, as potters' clay, and silececous and argillaceous substances, afford facts of like kind.

The microscope has also enabled Ehrenberg to discover, that the tripolis of Bilin and St. Fiora are constituted entirely of the bodies of infusoria, of the family bacillariæ, and certain genera, readily distinguished. The tripolis originated in lakes, or in the sea.

Lonsdale has discovered, with the microscope, that corallines and minute shells compose white chalk.

Microscopes shew no surrounding current, or concentrating motions, while crystals are forming. A point is formed, and it augments rapidly without agitation. In this way atmospheric clouds are formed.

Mr. Craig, with a powerful microscope, observed the union of carbonate of copper and nitric acid. The carbonic acid was seen to evolve quickly in beautiful globules, which, mingled as the nitrate of copper, was formed. Massy crystals of deep blue remained, while multitudes of rhombic tabular crystals were deposited. A drop of ammonia instantly dissolved the crystals of the nitrate, and nitrate of ammonia with groupes of prisms spread over the glass. He also observed some other unions and changes in other mixtures, and very active currents.

Ehrenberg calculates 41 millions of individuals in a cubic inch of tripoli.

Fragments of insects, wings of *fuci*, sea-weed, woods, &c. are shown upon an exaggerated scale. Hairs of an infant appear like tubes two inches in diameter. A small portion of the fine skin of the human *pericardium* exhibits the courses of the arteries and veins. It reveals the interior conformation of fleas and spiders. The sting of a bee is a monstrous barbed weapon, 4 feet long. The lancets of the horse-fly are sabres about 2 feet in length. Small animalculæ, in a drop of water, are seen preying on each other. Skeleton larvæ are beautifully developed, exhibiting even the vesicle of air which enables them to rise or descend in water. Worms found in stagnant ditches, the natural size of a thread, appear like a boa-constrictor. The instrument was first constructed by Cooper, and Carey the optician. It is open to exhibition.

A sphere of plate-glass gives a focus at half the radius beyond the sphere One of diamond is half the focus, half way within the sphere, and one of sapphire carries it to the opposite surface.

The shortest double convex glass lenses have the 60th of an inch focus, *i. e.* $60 \times 10 = 600$ power. But the field is painfully limited. Sapphire has been made of the 100th or 1000th power, and, as a single lens, is the best microscope for very small objects or parts. The solar microscope and the

hydro-oxygen may have the power of 1000 in line, or 1 million in area, with ample field of view.—*See Wonders of Microscope.*

The test objects for microscopes are the wing of the menelaus, and the hairs of the bat and mouse.

The highest lenses of Lewenhoeck's microscopes were but the 20th of an inch. They magnified the diameter 100 times, and the surface 10,000 times. The 50th of an inch magnifies the same 500 and 250,000. An inch focus magnifies but 5 and 25, and a half inch 10 and 100.

The lenses in the eye of the house-fly have the 100th of an inch focus. In other insects the entire cornea is composed of distinct lenses and a tube, and a second lens renders them perfect round microscopes!

A micrometer is a simple arrangement of cross hairs, or fine fibres, in the anterior focus of the eye-glass of a telescope or microscope; and when its measures are determined for one object, it applies to all. They have been made to the 10,000th of an inch. The screws that move them have from 100 to 300 threads to an inch, with divisions for parts of a revolution. Spiders' webs the 96,000th of an inch, gold wire less than the 5000th, glass threads the 1200th, and fibres of asbestos 4000th, have all been used for cross threads.

SOUND AND MUSIC.

Sound arises from vibrations of the air, as may be *seen* by the vibrations in the water of a musical glass, and by the affections of light bodies, laid on strings in concord; and they may be *felt* by the vibrations of all instruments.

The delicacy and intensity with which they reach the ear, proves the extreme fullness of space in aerial atoms. We distinguish tones when the vibrations are 7000 in a second, and therefore the particles must be less than the 56,000th of an inch asunder, considering the gravest tone as the eighth of an inch. This coincides, too, with waves of light, which appear, in red, to be the 40,000th of an inch asunder, and in violet the 64,000th.

The lowest tone which the ear can discriminate is, according to some, 12½ undulations in a second, and, to others, 30; and, the most acute, above 6000.

Every sound is a mixture of 3 tones, just as a ray of light is of 3 colours. The union of the key-note with the 5th and 10th, is the common chord. The diatonic scale is the prism of sound.

Sound and light, or tones and colours, are produced by two different affections of the very same medium. White light may be decomposed into three colours, and every sound is a compound of three tones. Atoms of oxygen and nitrogen, in conjunction, may produce one, oxygen another, and nitrogen a third, both in light and in sound. One is the excitement of propulsion of atoms, called light, and the other the propulsion of a gross volume, called sound. Every propulsion of the aerial elements, called light, includes, in analysis, the prismatic scale, and every vibration in the same elements, in analysis, produces the diatonic scale. Both scales, too, are chemical, and are produced by the very atoms which produce all our chemical and electrical phenomena. The scales, too, are similar, because they are the measures of the effects on the same sensorium. The numbers agree, since a volume of five parts of atmospheric air is four measures of nitrogen and one oxygen, and every sound is composed of the fundamental note, its fifth and tenth, whose square, or force, is 25 and 100, or 1 to 4. In the spectrum, Young determines the red to be 16, yellow 1, and light blue 23, blue 36, and violet 25, in 100; which, for red only, would be about 20 to 100, and, for the rest, 80 to 100; *i. e.* 1 to 4, the exact proportions of oxygen and nitrogen in volume, or 20 and 80 to 100 by weight, and also of tones in a sound.

Mere vibration of air would be productive of no variety of tone, if the primary vibrations were not various, and were not accordant, or the contrary. The diatonic scale merely reduces this accordance to the ratio of numbers. Of course, double velocities produce octaves of greater intensity, and then in these we have a second scale, and so on, upward and downward. It is arithmetic applied to vibrations and their effects on the sense.

Primary colours, RED, YELLOW, and BLUE, correspond to the primary sounds C, E, and G. The proportions in the spectrum are 5, 3, and 8. Every 2 produce a colour, and the 3 produce white, making 7, just as in the diatonic scale. The secondaries are *orange*, of red and yellow, 5 and 3. *Purple*, of red and blue, 5 and 8. *Green*, of yellow and blue, 3 and 8. The whole white. The red and yellow 5 + 3 are equal to the blue 8. The vibrations of C are 480, of E 300, and of G 360, *i. e.* 8, 5, 6, the length of the string by the vibrations being 40 in each.

The artificial commas begin at 612, and diminish to 0, or 51 on each note.

Euler makes A 6000, F 7500, and E 8000; and their commas 451, 254, and 197.

A string or rod struck in the middle vibrates in nodes or portions, and these are to the vibrations of the whole string, as the N + 1 squared to 1.

All undulations of sound resolve themselves into nodes, or definite parts, as halves, thirds, fourths, &c., and these are rendered sensible to the eye by sand placed on plates, which are vibrated by the bow of a violin. The forms produced by the nodal points of rest are most curious; and, illustrated by Chladni, and explained by Whetstone, are among the most striking novelties of science.

In every string, fastened at both ends, there is a continuous set of intermediate notes, reflected as it were, along it in subordination to the resultant effect.

The nodal divisions of the vibrations are formed by laying fine copper-wire across the glass, or by four little wire-hooks suspended

on the edge. Sympathy gives fixed nodes, the violin bow determines a middle point, and the finger gives variable nodes. Ether on the surface of water is star-like.

The lowest note, says Mr. Tomlinson, is produced by 4 vibratory arcs; the next higher by 6 arcs; and other higher ones by 2 more; 5 or more notes can be produced from one glass, and each a different octave.

Savart made wheels with teeth, to measure intervals of tones. With one of 360 teeth, he varied the velocity, and the tones in bodies, struck by the teeth, were pure at 3000 or 4000 per second. With a wheel having 720 teeth, at 12,000 strokes in a second, the separate tones were discriminated by himself and others, though double that number of vibrations. With a revolving bar of iron, he produced low notes at only 8 to the second, or 16 vibrations.

Nodal points are created by oscillations in contrary directions, by which a state of local rest arises; and vibration itself arises from the disturbance of the fibres, or connecting parts of the body, when the action of the other parts are to be brought back. These, then, excite the air in juxtaposition, and create in it vibrations or sounds.

All sound appears to be echo or reflection; and if not a distinct echo, it is only for want of distance. In a real echo, the first sound is from near surfaces; the second, or echo, from the distant surface.

Sounds, in liquids and solids, are more efficient and more rapid than in air. Two stones, rubbed in water, may be heard in water at half a mile. Cast-iron conducts sound with ten and a half times the velocity of air. A string, or piece of deal, held to the ear, or between the teeth, gives a vast increase of effect. And pipes convey sounds to vast distances.

Sound is lost in passing from one medium to another, and hence, as we produce sounds by vibrating solids, the effect in air is less.

At the temperature of freezing, 33°, the velocity of sound in air is 1100 feet per second.

For lower temperatures deduct } ½ a foot.
For higher temperatures add }

Thus, at the temperature of 50°, the velocity of sound is $1100 + \frac{1}{2}(50 - 33) = 1108\frac{1}{2}$ feet. At temperature 60°, it is $1100 + \frac{1}{2}(60 - 33) = 1113\frac{1}{2}$ feet.

In dry air at 32°, sound travels 1090 feet per second, and one foot more for every degree of the thermometer, so that at 82, it travels 1140, or 775 miles an hour. The action of sound so diminishes the orbit velocity of atoms of ærial gas, as to occasion them to communicate part of their motion in very small degrees of heat.

Sounds are distinct at twice the distance on water that they are on land.

Parry's experiments, at — 17° 27′ F., was 1035° 19′; and of Franklin's, at — 9° 14′ F., was 1069° 28′.

In a balloon, the barking of dogs on the ground may be heard at an elevation of 3 or 4 miles. On Table Mountain, a mile above Cape Town, every noise in it, and even words, may be heard distinctly.

The velocity of waves of sound, in an elastic medium, is equal to the velocity of a body falling through the half atmosphere or heights of the modulus of elasticity, or half 27,800 feet.

The fire of the English, on landing in Egypt, was distinctly heard 130 miles.

Dr Jamieson says, in calm weather he heard every word of a sermon at the distance of 2 miles.

Sounds are more intense as the air is denser.

In the Arctic regions, persons can converse at more than a mile distant, when the thermometer is below zero.

The report of a distant gun is heard before the word fire, which directs the discharge.

Water is a better conductor of sound than air. Wood, also, is a powerful conductor of sound, and so is flannel or ribbon.

The sound of a bell dies away as the exhaustion by an air-pump proceeds; but sound continues, since the exhaustion cannot be perfect.

A bell not only does not sound in an exhausted receiver, but if in a receiver not exhausted and covered by another, and the intervening space exhausted, that void space will not conduct the sound.

Sound affects particles of dust in a sunbeam; cobwebs and water in musical glasses; it shakes small pieces of paper off a string in concord. Deaf persons may converse through deal rods held between the teeth, or held to their throat or breast.

A bell does not in water produce a tone, but a short noise, like two knives struck together. The agitation of the water produces no change. In the water, a large bell is heard 45,000 feet; but in the air, out of the water, but 656 feet.

In sound, as in light, the angle of incidence is equal to the angle of reflection. The laws of catoptrics apply to sound.

Echoes are distinguished, when the time between delivering a sound, to its return, is more than 1-12th of a second, and as the sound goes and returns, so, to the speaker, there can be no echo in less than $\frac{1130}{24}$, or 47 feet; and syllables cannot be repeated in less than 1-7th of a second more, or 161 feet for each syllable.

The distance to produce an echo between the foci must be equal to the distance which sounds travel in distinct succession. The eye and ear appear to be capable of receiving about 8 or 9 impressions in a second. Then, as the *reflected* sound must travel over the extra distance of the foci, these points must be $\frac{1142}{9}$ asunder, or 127 feet asunder, or as many times 127 feet as we hear, or desire to hear, distinct sounds. An echo depends, therefore, on the existence of a sufficient number of surfaces to form ellipses, which should admit of 2 foci, of 127 feet or upwards, or for different sounds, of multiples of 127 feet, and then, as the surfaces in accordance are more extended, the

first, second, &c. echoes will be more or less perfect. If we desire to hear 4 sounds of 9 per second, we must be distant from the object $\frac{1142 \times 4}{9} = 508$ feet, and this is a general rule. We may hear a whole syllable of 9 per second, at 127 feet, and half a syllable at 64 feet. The common method of drawing an ellipse, by a piece of thread fixed to pins in the foci, will illustrate the entire theory, the lines being to be considered as sounds going and returning.

A cannon-ball, issuing from a full charge, moves with the velocity of sound, *i. e.* nearly 400 yards per second; a mile in 4½ seconds.

Sound travels, in air, about 900 feet for every pulsation of a healthy person, at 75 in a minute.

The velocity of sounds are equal at every pitch.

The closer contact of the molecules of water enables it to conduct sound created in it 4708 feet per second, or with above 4 times the velocity of air. In the lake of Geneva, the sound of a bell was conveyed 9 miles in 10 seconds; but, owing to the less elasticity, it does not go round obstructions like sound in air.

In passing from water, &c. into air, sound appears to be reflected inwardly at low angles.

In sound, light, &c. the molecules, or atoms of the medium, merely oscillate or vibrate, and are not carried out of their relative places.

Solid bodies transmit sounds to great lengths. The scratch of a pin at one end of a beam is heard at the other end; and it is believed that a bar of iron 10 miles long, would transmit sounds in no sensible time.

The ear is not fitted to receive two loud sounds in succession. In verses for music, the syllables should follow in the same order of accents as the sounds. Wolcot and Moore have this excellence.

These beautiful experiments have been varied in striking ways. Paper or parchment, fixed over a glass vessel, and strewed with sand, may be made to imitate all the nodal lines on sand produced, sounding a plate of glass held over it. Even the nodal lines in a room, produced by a continuous tone, may be discriminated in the air within it and beyond it.

All are so many proofs of the absolute plenum of matter in motion, and of the connection of force with force, however apparently disunited. How palpably absurd to separate the sun and planets, and connect them again by such fancies of human creation, as attraction and gravitation! Nor is there any wonder in the whole, for it is a necessary consequence of the subservience of matter to motion, and of the similarity of the mechanism of atomic and massive phenomena.

The effect of vibrations on sand is shewn by Chladni, and the figures are regular, and extremely curious, such as waving circles with eccentric lines, regular figures, &c. &c.

A sounding board communicates the vibration near it to the whole mass of air, and best when perpendicular, to the vibrations. A sounding-board placed near an instrument, or an orchestra, and connected by a metallic with a sounding-board in a distant apartment, will convey every tone in miniature like the figure of a landscape in the focus of a lens.

In wind instruments, a blast of air puts the internal volume into longitudinal vibrations; and these generate nodal points or harmonics, which vibrate in accord, and produce a resultant tone by waves the same length as the pipe. If the pipe is closed at one end, its note will be an octave lower, or reflected back of double length. A steady blast produces the fundamental tone, and, by increasing it, the vibrations are returned, and nodal points generated spontaneously, between which the vibrations are reflected, or contrary.

When the action of the molecules cannot diverge, as in pipes, whispers may be heard at the distance of a mile, with a velocity of 1120 feet per second.

Sound is interrupted, or stayed, when any other molecular action is taking place in its conductor, and hence is more intense by night than by day. So sounds interfere with one another, just like the light of the sun in obscuring the stars.

Sympathetic sounds are created in strings, or volumes of air in unison. A string 2 or 3 times the length of an excited one will adopt the tones of the shorter. A tuning-fork will excite every unison, or possible unison, by contact with a harp or piano. And the accordant pipes in an organ will sound in sympathy with an unison.

In a tuning-fork, the vibrations so interfere as to produce one tone.

The vibrations of air, in sound, have been aptly likened to the action of wind on the heads of a field of corn with their elastic stalks.

When strings are not in perfect unison, they produce, by interference of oscillations, beats, or silent vibrations; and augmented ones, in every second, creating a rattling on the tone, called discord.

The human ear recognizes 9 octaves, *i. e.* the lowest on the organ to the squeak of the Grylli. Other animals may have audible perceptions, both lower and higher. And it is supposed that the human ear might discriminate above 9 octaves, if the magnitude of impulses were increased.

The sense of hearing arises from an expansion of nerves into the inner chamber of the ear, and these receive the vibrations of the tympanum, a strained membrane. This elastic membrane is *damped* by a small bone, called the *mallet*, but, like a drum, it will not transmit to the brain two loud sounds in immediate succession.

The notes of the musical scale are formed by the contraction or enlargement of the *rima glotidis*, an aperture in the larynx over the windpipe. It is like the reed in wind instruments, but susceptible of the most delicate variations.

The point of action in the voice is in the throat, and level with the hair in the back of the neck. As singers raise or lower this point, the tone is harsh, hard, thick, throaty, and gutteral.—*Gardiner.*

High notes are produced by lessening the aperture, and increasing the velocity of the breath. If the lowest notes would permit the passage of a billiard ball, the highest should permit but a pea.—*Ibid.*

Miners distinguish the substance bored by the sound; and physicians distinguish the action of the heart by a listening tube. Gamblers and pie-men can distinguish, in tossing money, which side is undermost, though covered by the hand.—*Gardiner.*

The nose and roof of the mouth are the sounding-board of the voice; the teeth, the bridge of the lips and tongue, on whose activity, form, and skilful use depend the modulations of tone. The speaking voice is a machine, whose use children should be taught.—*Music of Nature.*

M. Kempelon, an Hungarian, lately made a speaking-machine. It consisted of a reed, or glottis, of air-chest with valves, bellows for lungs, a mouth and jaws, and nostrils. It pronounced most letters perfectly, but D, K, G, and T, imperfectly; and even long words and sentences with great facility.

Willis, availing himself of the study of the larynx, has applied tubes to a reed, so as to pronounce all the vowels in two orders, according to the change of direction in the vibration on each side the nodal points of his tube.

Hearing requires an impulse during the 10th of a second.

The buzzing of insects does not proceed from the wings, but from organs in the thorax.

Tones may, it is said, be discriminated up to 14,000 vibrations per second. Hence, as a string in C gives 480 vibrations, sound is capable of expressing 9 octaves between 30 vibrations, 3 lower than the staff, and 4 above it.

Adagio is slow time; *andante*, middle time; *allegro*, quick time. In adagio, the crotchet accords with a pulsation; in andante, the quaver with the trotting of a horse. Allegro is double-adagio.—*Gardiner.*

The lengths of string, and the vibrations per second, for the eight possible octaves, are as under:—

	Length.	Vibrations.
Ledger below	80000	30
	40000	60
	20000	120
	10000	240
C staff..........	5000	480
Ledger above	2500	960
	1250	1920
	625	3840
	312·5	7680

The lowest note of 30 vibrations would, therefore, be expressed by a string eight times the length of the lowest note of the C scale on the staff; and the highest note of the highest octave by a string but one 16th of the string which expresses the highest note of the octave C on the staff. Of course, as twice 7680 vibrations is 15,360 vibrations, and this is above the power of the ear, so above 7680 would be merely a shriek.

According to the accurate calculations of Farey, the following are the length of the strings, and the number of vibrations of each in a second of time, in the octave of eight notes, three sharps, and two flats:—

	Length.	Vibrations
C natural........	5000	480
B natural........	5297	453
B flat	5612	428
A natural........	5946	404
G sharp	6300	381
G natural........	6674	360
F sharp	7071	339
F natural........	7491	320
E natural........	7937	302
E flat	8409	285
D natural........	8909	269
C sharp	9439	254
c, lower octave ..	10000	240

The vibrations for the same note, whatever the instrument, must be alike. The quality of the note depends on the instrument, and on the perfection of the vibration. Difficulties may arise, but the notes and octaves are a fact.

A musical glass maintains its tone till water has been poured in 13 of 31 parts of the heighth, which 13 is the axis; the same for the same glass and same fluid, but different for different glasses and fluids. If 13 of 31 in water produce C, it requires 14 to produce B; 21 to produce A; 29 F, and 30 E, or fullness, nearly. But if mercury is used instead of water for the axis, then 6·5 of 31 produces C; and 8 B; 10 B flat; F sharp 14; F 15; E 15·5; D 17. For linseed oil, the axis of 31 parts is C 14·5; B 16; A 22; G 27; F 30. In olive oil C is 12·5; B 17·5; and G 27·5.

Musical glasses are tuned by sounding the notes on a flute, so as to produce the sympathetic note on the glass.

Oils and acids do not vibrate unless heated; oil vibrates as freely as water at 340°, linseed at 367°, and sulphuric acid at 239°.

Mercury, by itself, and in combination, produces stars of various figures. Light bodies laid on mercury revolve contrary ways, but on water, &c. as the finger.

When a string in C is divided in the middle by a bridge, the 2 sides vibrate an octave higher, and in contrary directions. A 4th gives a double octave, and a 3d of the length gives the 12th above C.

Pipes of the same size, whatever the material, give the same tone.

Pythagoras is said to have invented harmonic strings, in consequence of hearing four blacksmiths working with hammers in harmony, whose weights he found to be 6, 8, 9, and 12; or rather, by squares, as 36, 64, 81, and 144.

De Guignes and Wain concur in pronouncing Chinese music a mass of detestable discord. Large wooden drums, bells of cast-iron, hollow copper, or brazen bowls, pieces

of hard wood, struck one against the other, or with small rods, cymbals, flutes, trumpets, brass bells, small drums, guitars, &c., are the instruments. Several kinds of trumpet are used, some of them very long and thin, having sliding joints to render them more portable. In addition, there is a species of harmonica, which has a delightful tone, and a kind of harp or lute, which is played in a horizontal position. Few barbarous instruments are more celebrated than the *gong*. Military gongs are distinguished by being deeper and heavier. Civil gongs are quite shallow, and appear like a circular sheet of metal simply turned up two inches all round.

All ancient music was in the minor key, without harmony or counterpoint, and entirely vocal and rhythmical, like our recitative.—*Burney.*

Prudentius, in the fourth century, set notes to the Romish breviary; and Flavianus established the first choir at Antioch.

Melody is formed of the same sounds as harmony; but the notes, instead of being struck together, are made to follow in succession. Melody is the result of harmony.

Instrumental music is deemed the basis of the art, and vocal a branch. In its combinations from the duo to the symphony, the quartette is most refined. The chief pleasure is in the taste of the performers, and in the expression with which the second, the tenor, and the bass, answer the imagination of the first violin.

The study of harmony, and the laws of counterpoint, confer a new pleasure and new sense.—*E. Taylor.*

The Gamut is so called from *gamma*, the third letter of the Greek alphabet, used by Guido for his lowest note. It consists of 20 notes, two octaves, and a major sixth. The first expressed by capitals, the second by small letters, and the rest by double small letters, as G, A, B, &c. g, a, b, &c. and g g, a a, &c. It is now extended to an entire scale of five or six octaves.

The quality of a musical tone depends on its suddenness and singleness, and the intensity of the effect on the force and magnitude of the impulse. The pitch which varies with the intensity of vibration determines harmony.

In octaves, the vibrations are as 2 to 1, and they coincide every alternate vibration. But when the strings are as 2 to 3, every *third* vibration of one corresponds only with every *second* of the other, and they are called fifths.

Complication, in music, advances with the musical education of the ear. The breve, now so long as not to be used, was so called from its once-esteemed brevity. The grave and sober Corelli and Arne gave way to Haydn and Mozart, who, in turn, give way to Beethoven and Rossini.

The sound called the breve, in ancient music, is now divided into 64 demi-semi-quavers, and sometimes in 128 notes of slow movements. The division is into 2 semi-breves, 4 minims, 8 crotchets, 16 quavers, 32 semi-quavers, and 64 demi-semi-quavers; or half, if the semi-breve is fundamental.

The most perfect musical composers are Handel, Jomelli, Cimarosa, Mozart, Haydn, Beethoven, Rossini, and Spohr.

Modern composers use nearly 50 marks of expression. Handel and Correlli had but 5 or 6.

Beethoven, in one of his compositions for piano-effect, has marked 200 notes to be played in one bow; and, in another, he assigned 43 bars to one bow of the viola.

Ferlandi played on an oboe with one leather joint, by twisting which, he imitated the tones of the human wind pipe.

Mozart excelled in operas and airs, and the adaptation of accompaniments. Haydn excelled in symphonies and quartetts; but, even in these, Mozart excelled. Both of them declared Handel their superior. Beethoven and Weber were other master-geniuses. Beethoven was deaf in his last 10 years, and in that time produced his best compositions.—*Gardiner.*

Paganini was, from his early youth, a musical prodigy; his fame at 14 or 15 drawing large audiences in every city of Italy, and serving to enrich his parents. At Lucca, he played a love-scene between a lady with the 1st string and a gentleman with the 4th string with such effect, that the Duchess Eliza Bonaparte suggested a trial with *one string*, and he produced a sonato with the 4th string, which had a compass of 3 octaves complete. At Florence, Turin, Milan, &c., by indefatigable exercises, he maddened the public by his performances. He then visited Vienna, Prague, Dresden, and Berlin, astonishing all performers, and overwhelming all amateurs; and, finally, he fascinated Paris and London, in 1831, and the large towns of England.

The modern Egyptians play on a single string, but with no other resemblance of Paganini.

Rossini is the greatest living composer, not merely in quantity, but originality and sublimity.

Corelli is the head of the old school of performers, and Viotti of the modern. Corelli died in 1713, aged 60; and Viotti in 1824, aged 69.

The works of Corelli may be performed without touching the 4th string of the tenor or violincello.

The qualifications, says Gardiner, for a prima donna, are power, beauty, and correctness, with taste and expression; and for the theatre, action and a dramatic mind.

A conductor, distinct from the first violin, is essential to the success of every public performance.

Church music was first systematized on the practices at Antioch, by St. Ambrose, and, afterwards improved by the chant of Pope Gregory the First, or Great, about 690. The notes were letters over the syllables; but Guido d'Arezzo, in 1100, invented the gamut, and musical notation. Palestrina, about 1560, was another great im-

prover. Marbeck, of Windsor, arranged the reformed service, in 1550.

Others say, that Pope Gregory invented chanting. He also repeated the same seven letters for successive octaves, previously designated by fifteen letters. Points were placed in lines over the letters, which Guido, in 1022, simplified by rejecting the letters, and expressed the notes by the points only, and superadded the system of *solmisation*, instead of the Greek ta, te, the, tho.

Luther was the inventor of metrical psalmody, about 1517, and it spread with the Reformation. The first tunes were the popular airs and dances. The old hundredth was a love-ditty; *Rebuke me not*, was a jig; and *Stand up, O Lord*, was a Poitou-dance.

Gardiner, under the sanction of George IV. and Archbishop Manners, adapted 220 strains of Haydn, Mozart, and Beethoven, to as many of the best versions of the psalms.

Madrigals, for four or five voices, were very fashionable in the seventeenth century, when Marinzio, Este, Morley, and Wilbye, composed the still favourite ones. Catches are of the same age.

Scotch music is referred to their James I. The tunes, in which the 4th and 7th are omitted, seem to be formed from the Greek lyre, of 6 or 7 strings. They were first performed in a London concert, in 1722.

The Scalds were poets and priests of Iceland, whose rhapsodies form the Edda, and other poems.

The same instrument governs all its own relations. If an organ pipe of 16 feet sounds the lowest note 3 octaves below the line, the exact relation is preserved: if the next octaves above have pipes of 8 feet, 2 and 1 feet, then 6 inches, 3 and $1\frac{1}{2}$ in 7 octaves. The harp rises through 6 octaves, the piano through 5, 3 above and 3 below the line. The violin, 2 above and $\frac{1}{2}$ below; the violincello, 2 below and 2 notes above. The clarionet, $2\frac{5}{7}$ above and $\frac{5}{7}$ths below; the flute, 2 above and $\frac{5}{7}$ths below. The treble voice has 2 octaves above the line. The mezzo has $1\frac{5}{7}$th above and $\frac{1}{7}$ below. The counter tenor is $1\frac{4}{7}$th above and $\frac{4}{7}$ths below; the tenor $\frac{5}{7}$ths above and below. The bass is $1\frac{4}{7}$ths below and $\frac{4}{7}$ths above.

The English excel in anthems, and Tallis, Birde, Farrant, Gibbons, Blow, Purcell, Wise, Clarke, Croft, Green, Boyce, and Nares, are celebrated.

Musically speaking, Gardiner observes, that England has not produced an original idea. He ascribes the thoughts of Purcell and Arne to Italians, and our grave Church music to the Flemings.

Carissimi wrote the first air for a single voice. Previously they were mataltos, madrigals, &c.

In music, excellence arises from melody, harmony, and expression; and in painting, from design, colouring, and expression.

Quartetts produce all the chords, and most of the accents connected with expression.

Counter-point, or melody with harmony, as treble and bass, was invented by Guido, about 1022; and the time-table by Frameo, in 1080.

The modern system gives 24 notes to the octave.

B sharp	F sharp
C natural	G flat
C sharp	F double sharp
D flat	G natural
C double sharp	G sharp
D natural	A flat
D sharp	A natural
E flat	B double flat
E natural	A sharp
F flat	B flat
E sharp	B natural
F natural	C flat

These can be performed only with the voice or stringed-instruments.

The common scale has 12 notes, and includes 3 sharps and 2 flats; but exact intervals demand 6 other sharps and 6 other flats in a perfectly-divided octave.

C to D, D to E, F to G, G to A, and A to B are tones. E to F and B to C are semitones. The strings are 1 for C, 8-9ths for D, 4 5ths for E, 3 4ths for F, 2 3ds for G, 3-5ths for A, 5 15ths for B, $\frac{1}{2}$ for C.

Every string when struck produces, besides its own note, three sounds easily distinguished: 1 an octave higher, a 12th, and a double octave, called acute harmonics.

When a string is vibrated, the ear discriminates the principal sound and its octave, and also two high sounds, one a twelfth, or octave, to the fifth, or two-thirds the string, and the other the 17th major, or double octave of its third major, or four-fifths of the string. So that we get (1) the sound of the whole string, (2) of half the string, (3) of $\frac{1}{2}$ of $\frac{2}{3} = \frac{1}{3}$, and (4) $\frac{1}{4}$ of $\frac{4}{5}$ths, or $\frac{1}{5}$th. That is, $1 + \frac{1}{2} + \frac{1}{3} + \frac{1}{5}$, or $1 + \frac{15}{30} + \frac{10}{30}$ + and $+ \frac{6}{30}$, or $1 + 1\frac{1}{30}$th. This is the result of the *sum* of all the vibrations of all the parts of the string; for the centre has one vibration, and the end, from the centre to the fixed points at both ends, have their own vibrations, which on both sides are doubled.

The unison octave is the major fifth, and major and minor thirds, and the major and minor sixths are concords; the three first are perfect, and the two last imperfect. Common chords are a key-note, with its third and fifth, and major or minor, just as the third is major or minor.

There are 4 or 5 clefs or keys. The G, or *treble* key, on the second line. The F, or *bass* key, on the fourth line. The C, or *tenor* clef, on the fourth line. The *counter-tenor* clef on the third line. And the *soprano* clef on the first line. The key is the ground-work of any system of notes, and gives character to the composition. Old songs were in G *minor*.

A third note, made by two whole tones,

is called a *major* third; but if made by a tone and semi-tone, it is a *minor* third.

The perfect fifth consists of a major third and minor third, or two major tones, one minor, and a semi-tone. That from D to A is 1 major, 2 minor, and 1 semi-tone, and is flatter than the true fifth.

On account of the imperfection of instruments with 12 or even 24 notes, the tuner adopts a temperament by taking the fifths too flat; by which the errors are masked or compensated in ascending and descending.

In tuning by fifths, from C to G, and G to d, and from d to D, C D is a *major* interval. But, tuning A as fifth to D, and e as fifth to A, then E downward, as octave to e, would be major to D, and the intervals C E by two *major* tones, and E much too sharp. If, however, E be tuned as major third to C, the interval D E is less than the former D E, and, therefore, the *minor* tone. Then the difference between the first and second D E is THE COMMA.

The exact natural divisions are not tones and semi-tones, for the longer intervals of semi-tones are greater than half. C to D is, therefore, called a tone major, D to E a tone *minor*, E to F a semi-tone, F to G tone *major*, G to A tone *minor*, A to B tone major, and B to C semi-tone; that is, three major tones, two minors, and two diatonic semi-tones.

Three chords, the *tonic*, or key-note, third and fifth, the *dominant*, the second and seventh, and the *sub-dominant*, the fourth and sixth, are the radical parts of every scale, minor and major; and all melodies have the perfect concords of these keys for their fundamental bases.—*Callcott.*

The Liston, or enharmonic system, adds 29 notes to the 24, making 53; and an organ has been set up with 39 notes in the octave.

Thorough bass is the art of expressing, by musical characters, the harmonic combination of notes, which are to be struck with the right-hand upon the piano-forte, in accordance with any given note in the bass, which is struck with the left-hand.—*Gardiner.*

Melody belongs to the imagination, and not to science. It is the gift of rude invention, and, like feeling and sentiment, belongs to nature. But harmony is a work of art, and, in combining simultaneous sounds, affords the intellectual enjoyment of a succession of proper chords, only to be felt by the instructed.

Modulation is an effect of the principal key, to which the melody returns after any transitions, and in which it concludes.

The cadence, or conclusion of every composition, is a change in the harmony, from the dominant to the tonic, or the tonic to the dominant. It is a progression from the harmony of the fifth of the key to the key itself, and is called the perfect cadence.—*Callcott.*

Melody is the system of sounds, which follow each other at diatonic distances, or intervals; and when they do not so follow, sounds are mere noise.

When F is made the key or base of any melody, the effect is rich and grave; but its relative, D minor, is more sombre.

C is bold and energetic; and its relative, A minor, is similar, but plaintive.

G is gay and lively; but its relative, E minor, soft and tender.

D is grand and lofty; but its relative, B minor, complaining.

A is glowing; but F *sharp*, minor, mournful.

The *sharps* of E are brilliant and sparkling.

The *sharps* of B are piercing.

B *flat* is dull, and G minor, melancholy.

E *flat* is mellow and soft, and C minor, complaining.

A *flat* is delicate and tender; but its relative, F minor, gloomy.

D flat, major, is solemn and awful.

Assimilating tones to colours, Gardiner considers the trombone as deep red; the trumpet, scarlet; the clarionet, orange; the oboe, yellow; the bassoon, deep yellow; the diapason, green; the flute, blue; the horn, violet; the violin, pink; the violincello, red.

Gardiner, in his *Music of Nature*, has put into notes the songs of 24 birds, and 20 animals. Also, about 20 expressions of human passion and feeling, and tones of 8 or 10 insects. The *gnat* gives the note, A on the second space. The *death-watch* calls in B flat, and answers in G. The three notes of the *cricket* are in B. The buz of a *bee-hive* is in F. The wings of the *house-fly* are F in the first space. The *humble-bee* is an octave lower. The *cock-chafer* is F below the line.

The art of singing is new, and, till the last century, was the mere result of good voice. Female performers were not employed till the Restoration; and the first Italian lady appeared in London, in 1692. Mrs. Tofts, Mrs. Anastasia Robinson, Miss Brent, and Miss Young, were the precursors of Mara, Billington, Salmon, Catalani, Grassini, Pasta, Sontag, Ronzi, Malibran, Paton Wood, Stephens, &c. &c. Since singing became a science, male singers have been more rare; and Farinelli was the wonder of one age, as Braham has been of our own.

Farinelli could sing 300 notes without drawing breath; while 50 exhausts most singers.

The vocal tone extends wider than the speaking; and, hence, the advantage of chaunting in all religious assemblies, and of tones in street-cries.

The Italians call the lower notes the *voce de petto*, the voice of the breast; and the higher notes, the *voce de testa*, or voice of the head. The former is what is called the language of the heart; the latter, in men, is called *falsetto*.—*Gardiner.*

All voyces, great and small, base and shrill, weak or soft, may be holpen, and brought to a good point, by learning to singe.—*Ascham.*

A firm and decided tone is produced by quick opening of the mouth.

The great bell of St. Paul's is 8400 lbs.;

of Lincoln, 9894 lbs.; of Oxford, 17,000 lbs.; of Florence, 17,000 lbs.; of St. Peter's, 18,607 lbs.; of Erfurth, 28,224 lbs.; of Rouen, 43,000 lbs.; of Moscow, 160,000 lbs.; one unhung at Moscow, 440,000 lbs.; and there is one in China of 120,000 lbs.

A bell produces 4 or 5 distinct notes; the predominating depending on the part struck. The large bell of St. Paul's has a fundamental A, and secondary D, F sharp and A. All other vessels give a fundamental note, and often many secondary ones.

Large bells are 1-15th of the diameter thick, and 1-12th of the height. Bell-metal is made of copper and tin. Small bells, made of tin, silver, copper, or gold, give sounds in acuteness, as 253, 260, 282, 294, respectively. Bells were used in English churches about 700; and, for that purpose, *consecrated*, some say, *baptized*, with proper names given them. Popes themselves assisted. They were then supposed to put demons to flight, and were rung during eclipses, to drive away the dragon, which astrologers still recognize, by calling the northing node the dragon's head, and the southing node the dragon's tail; to which they ascribe potent effects. On St. John's Day, they were rung furiously, to put his devils to flight, and prevent storms. A Popish council, by formal decree, directed that bells should be blessed, to affright demons and witches, avert lightnings and whirlwinds, and baffle the spirits of the storm. For the benefit of departed souls, bells were also to be tolled; nine knells given for a man, six for a woman, and three for a child; a custom which still continues.

The cathedral at Antwerp has a musical combination of 33 bells, the largest 7 feet wide, and 8 feet high.

Peals of five and six bells are plaintive and melancholy. Those of eight and ten, lively and joyful.

The trebles of York Minster and Bow Church are 8¾ cwts., and the tenors 53 cwts.

Bell-ringing, as a system, is altogether English. A peal of 8 bells is the diatonic scale.

In Church bells no tunes can be played but such as are free from flats or sharps, or such as can be played on the white keys of the piano.

Church organs are in two parts, the main, and the little organ before the other. The largest pipe expresses the size, as 8, 16, or 32 feet organs. That at Ulm is 93 feet nigh, and 28 broad; its largest pipes, 13 inches bore, with 16 pair of bellows. The organ at Haerlem is 108 feet high, and 50 feet broad, with 5000 pipes, resembling columns of silver, from the ground to the roof. It produces a tone of thunder. The organ in the new church at Amsterdam has 52 whole stops, besides half-stops, and two rows of keys for the feet, and three for the hands; and a set of pipes that imitate a chorus of human voices. The famous Temple organ, in London, was erected by competition of Schmidt and Harris, two famous builders; and, after long-protracted disputes about their merits, the question was referred to Mr. Jeffries, afterwards Chief-Justice, and he decided in favour of Schmidt.

The flute, pipe, flageolet, and boy's whistle, were originally in the same form. The side flute was a German invention of the past century.

Cremona violins of 1660 are pure tone, and superior to all others: not so loud, but more effective in an orchestra.—*Gardiner.*

The pianoforte was invented, in London, about 1766, by Zumpi, a German.

The trombone is the sackbut of the ancients, and it was revived about 1790, after a model found in Pompeii. They produce every semi-tone, by sliding out and in, like a telescope tube.

The horn or trumpet has been played in a concert of two hundred trumpeters, from the size of a penny trumpet to those twenty feet long.—*Baillot.*

The compass of the *harp* extends through six octaves, from five lines below the bass clef, to six lines above the treble.

The *piano* through five octaves, and with extra keys to six.

The *guitar* through two and a quarter.

The *clarionet* three and a half.

The *horn* three.

The *bassoon* three.

The *flute* three.

The *violin* two and a half.

The *violincello* two and a quarter.

Human voices two; the Soprano, two notes below the treble, to three above; the Tenor, middle line of bass to middle of treble; the Bass, note below line of bass clef, to second line of treble.

In an *organ* of eight octaves, the pipes of the lowest are thirty-two feet, and of the highest one inch and a half.

The violin is the form of instrument which all men would adopt when seeking to produce vibrations. Its forms would vary, but the principle would be constant. The harp, guitar, viola, &c. are variations, and brief experience would suggest the belly or sounding-board. The bow of horse-hair may have been more modern, but the necessity of passing one elastic material over another would be of early invention. The roof of Peterborough cathedral and Strutt's Pastimes, shew that the instrument was in use, at least, 500 years since, and, of course, not then invented. The cremona fiddles were made 250 years since, and they must be regarded as the perfection of an instrument of early antiquity. Taautus, Linus, and Orpheus, beyond question, used an instrument of the kind, and the lyre is one of the varieties.

The most effective and exhilirating of all wind instruments, is the "trompette a la piston," used in the village dances of France.

A complete violin is constructed of 58 different parts: sycamore is used for the back, neck, &c.; soft red deal for the belly; and ebony for the finger-board and tail-piece. There were three Amatis successors in the seventeenth century. Other cremonas

makers, of celebrity, were Straduarius and Guarnarius, an age later.

Musical boxes, &c. produce their tones by metal strings, which vibrate in their return to rest. In other cases, currents of air are made to act on them; and, hence, Wheatstone's symphonion, &c.

The lyre of the Greeks was the harp of the moderns; and the viol and vielle of the middle ages is the modern violin.

The lyre was invented by Taautus, and improved by Orpheus, Linus, and Thamyras. It had 11 strings, and was played on by a stick or the fingers.

Linus was the first lyric poet, and he added a string to the lyre.

Harps on the walls of the Egyptian tombs have 11 strings.

The ancients adopted three strings in their lyre, because every tone on one string is three tones; and then the three strings were of such lengths, that two of them perfected the two concealed or faint tones of the principal string. Then, as the two generated four concealed tones, so other four strings perfected these four tones, making seven strings. The octave string was added, as a sort of harmonic result to the seventh, and served to join the tones of the first and eighth in unison.

Greek instruments had no neck for shortening the strings.—*Montfauçon.*

A harp of the eleventh century is preserved in Trinity College, Dublin. A lyre was found in a tomb at Athens, like that of Apollo, with eight strings.

The bag-pipe, a Celtic musical instrument, much used in the Highlands and Ireland, is composed of a leathern bag; connected is a pipe or chanter, with a reed, and the passage of the air from the bag produces the tones. These are all drones, two in unison with D on the chanter, and a long drone an octave lower.

The organ was invented by one Ctesibius, a barber of Alexandria, about 100 B. C.

The Hon. Robert Boyle gravely published, that the sound of a drum, made of *wolf's skin*, would break another made of sheep's skin; and that a harp, strung with fox gut-strings, would make hens fly away. His philosophical writings, as well as those of Lord Bacon, abound in gross superstitions.

Emasculation for soprano voices took place at Rome, owing to female voices not being permitted in the churches or theatres. But, an opinion prevails, that when the operation is performed in bad weather, the voice is out of tune; hence, numbers of castratos are employed in menial offices both at Rome and Naples.

At the Reformation, organs were identified with the Catholic Religion, taken down, and their pipes sold for old metal. They were re-erected after the Restoration.

The best form of a concert-room is the double cube with a flat roof.

The Beggar's Opera travesties 69 ballads and country dances.

At the Musical Festival, in commemoration of Handel, in Westminster Abbey, 1784, and at that of 1834, the number of Instrumental and Vocal Performers were:—

	1784	1834
Violins	101	80
Tenors	32	32
Violincellos	30	18
Double Basses ..	18	18
Flutes	7	10
Oboes	26	12
Clarionets	—	8
Bassoons	27	12
Horns	12	10
Trumpets	14	8
Trombones	3	8
Ophicleides	—	2
Serpents	—	2
Drums	4	3
Great Drum	1	—
	275	223
Cantos	22	145
Altos	51	74
Tenors	66	70
Basses	69	108
	208	397
Instruments....	275	223
	483	620

A perfect orchestra, as arranged by Gardiner at two late oratorios, consisted of 82 stringed instruments, 22 wind, and 146 voices; in all 250, with an organ.

A late French orchestra consisted of 134 stringed instruments, 35 wind, and 178 voices; in all 346.

Latin prosody is false in principle. Words are of all lengths, not merely long or short. The Trochee and Iambic move in triple time, and the Dactyl and Sponde in common time, but the syllables are of every measure of length.—*Music of Nature.*

The words and syllables of language are like notes in music, of all lengths, and this is the rhythm of language. The adagios of Haydn and Beethoven consist of sounds of all lengths; and passages of Shakspeare and Milton are also combined of words slow and rapid.—*Ibid.*

For sound and music, words in the English language are not well assorted. It is powerful but rough, and though so copious, it is deficient in delicacy and flexibility.

The French speak in the nose, the Germans in the throat, and the English through the teeth.

PHILOLOGY.

It is estimated that there are 587 languages and general dialects in Europe, 937 in Asia, 226 in Africa, and 1264 in America; in all nearly 3000.

We are obliged to refer the transition of languages either to an indefinite antiquity of nations, or to distinct races of men. The principle is the same in all—names of things and names of actions, with qualities of things, modes of action, and relations of place. Powers of voice are as natural to

man as to animals and birds, and border tribes were likely to interchange their sounds. Monosyllables were the primitive sounds, and syllabic compounds would be results. Hence, all the fundamental tongues are monosyllabic as to generic ideas, and compounds species and varieties. The Sanscrit, Chinese, Welsh, Greek, Hebrew, German, &c. are formed on this principle.

Man appears to have vocal organs of great flexibility, and these, in every family, cave, or union of caves, would be the bases of a dialect. Two or more families would, of course, by association, club their stock of words, and fortuitous circumstances would expand the dominion of some one, and generate in time a nearly common language within physical boundaries.

Vocal sounds are the natural utterance of the human voice, similar in man to the sounds uttered by birds and animals, and by which they express a few generic ideas, without the complication and composition effected by human reason and greater compass of utterance.

Primitive sounds, or monosyllables, are, therefore, a-kin to each other in all the elder languages, as in Sanscrit, Chinese, Welsh, &c.; and all their words are composite, *i. e.* consist of the genus united to another, or to two or three to discriminate the species of the idea. Other languages are dialects compounded out of these, as English, French, Spanish, Italian, &c. and further complicated by words derived from one another. The Chinese have 214 radical words and signs of them, the Welsh about as many; and out of these by synthesis other words are formed, to the number of fifty or sixty thousand. Differences arise from the structure of the vocal organs, or from imitation of parents, or at present from corruptions, or as written from different powers of letters.

There are 20,000 words in Spanish; 25,000 in Latin; from 22 to 25,000 in English; 30,000 in French; 45,000 in Italian; 50,000 in Greek; and 80,000 in German. There are 1700 radical words in Hebrew, and 360 Chaldaic words in the Bible.

The first languages would consist of open vowel sounds, and their stops or consonants to discriminate the sense of the vowel sounds. Once formed, the Pedagogue would introduce rules, and give to a language its scholastic forms.

Accident would give the first links. The use of one part of the glottis, the preference of teeth, lips, nose, tongue, &c, would afford the key, and the rest would be radiation from that key. Usage would make one form of utterance as easy as another, and, hence, the strange diversity in which every animal sound is adopted and systematized.

The first voice is noise similar in principle to the drone of bagpipes, and the words and language are inflections and modulations. Even the vowel sounds vary with the parts employed in producing first sounds.

It is an epoch when contemplative man first began to represent ideas and sounds by drawings, and a greater epoch when these hieroglyphics were abbreviated into current written characters. These discoveries were, however, simultaneous, since different people made different abbreviations.

The Alphabets of different nations contain the following letters:

English	26	Latin	22
French	23	Greek	24
Italian	20	Hebrew, &c.	22
Spanish	27	Arabic	28
German	26	Persian	32
Sclavonic	27	Sanscrit	52
Russian	41	Chinese	214

Thoth, the Egyptian, who invented current writing, lived between the years 2800 or 3000 B. C. But, Josephus *says*, he had seen inscriptions by Seth, the son of Adam!

The first letter of the Phœnician and Hebrew alphabet was *Aleph*, which the Greeks called *Alpha*; and the moderns, by abbreviation, A. They also used letters to count; and *tau*, for 100, is, in the games of school-boys, the name of a white marble, worth many common ones. The word Alphabet is the letters *Alpha*, *Beta*, just as we say the A. B. C. The Hebrew language and letters are believed to be derived from the Phœnician, since Tyre, Sidon, &c. were distinguished cities in the age of Abraham, Moses, and Joshua.

Paper was made of the Papyrus shrub till 700 A. C., when cotton and silk paper came into use. Linen rags were not used till 1200 A. C. MSS. were either rolls or volumes of parchment, &c., or stitched books called *Codices*.

The oldest known MS. is part of the Iliad found in Upper Egypt.

There is a copy of the Gospels in the British Museum of the 8th century, by Eadfrid, Bishop of Durham, with additions by three other Bishops.

Sanscrit, the basis of Hindoo learning, is said in the east to be the first character. It is taught at Benares by pundits, or doctors: and the pupils there read the Puranas, or abridgments of the law, and study abstract philosophy, very like that of the Greek schools.

The alphabet of the Sanskrita is called the Devanagari.

Chaldee, Phœnician, or Syriac, ascribed to Adam, Enoch, Noah, Abraham, and Moses, is nearly the same as the Hebrew.

The Sanscrit contains 16 vowels and 34 consonants, and is probably the parent of most of the Oriental alphabets, even of the Greek.

Cadmus, the Phœnician, introduced the first Greek alphabet into Bœotia, where he settled, B. C. 1500; though Diodorus says the Pelasgian letters were prior to the Cadmean. But it is evident that the Cadmean and Pelasgic, and Phœnician, had the same origin. The Irish Alphabet is the Phœnician.

Scaliger supposes the Phœnician to have been the original Hebrew character, otherwise the Samaritan. It is that which was used by the Jews from Moses to the Captivity.

The Oriental Alphabets are Hebrew, ancient, modern, and rabbinical. Samaritan, ancient and modern. Phœnician. Syriac, ancient and modern. Egyptian hieroglyphic, and Chinese characters.

The Greek Alphabets were Cadmean, Pelasgian, Sigean, Nemean, Delian, Athenian, and Teian. Also Ionic, or the alphabet of Simonides.

The Alphabets derived from, or allied to, the Oriental Alphabets are, Cufic, Arabic, Persian, Saracen, Ethiopic, Mendean, Malabaric, Mantchou Tartar, Sanscrit, Japanese, Thibetan, and Rejang.

The Alphabets derived from the Oriental or Greek Alphabets are, Ancient Irish, Bobeloth and Bethluisnon. Ogums, namely, Croabh and O'Sullivan's. Coptic, Armenian, Georgian, Dalmatian, and Russian.

The Northern Alphabets are, Gothic, ancient, modern, and Mæso-Gothic. Runic. Welch. Deutsch, ancient and modern. Teutonic. German, printed and current. Flemish. French, ancient and current. Norman and Anglo-Norman. Bastard, ancient and round. Lombard. Charlemagne. Black Letter. Chancery, round and running. Court Text. Church Text.

The Chinese receive it as an undoubted fact, that, in high antiquity, *knotted cords* were made use of to signify the intention of the rulers, and to be, to a certain extent, the signs of ideas. It is said, that in the reign of *Hwang-te*, the third from *Fŭh-he*, a person called *Ts'hang-Hëë*, observing the appearance of a certain constellation, the marks on the shell of a turtle, and the impression of a horse's foot, first conceived the idea of forming letters.

There are strong resemblances between the Egyptian art of writing and the Chinese, but the latter is more artful than the former. Both, in effect, have an ideal and syllabic power, and also a phonetic or alphabetic power. This last seems to be the application of a principle which they developed to other nations, who sought only to assimilate sounds, and hence arrived at the alphabet without its hieroglyphic or ideotic, and its syllabic machinery.

Every age has had its peculiar style of penmanship, so that the age of any MS. may be assigned within half a century.

Champollion determined the meaning of about 140 hieroglyphic characters by his phonetic system, out of the 800 on the monuments. His theory, and that of Young, are germs for the future.

The decyphering of hieroglyphics is not admitted to be successful beyond proper names; but in these we arrive at certainty, and much knowledge.

In Sanscrit there are 52 letters, and 300 contractions.

The arrow-headed, or Zend characters, are alphabetical, and have been analyzed by Grotefend.

The Zend was the ancient language of Bactriana, of Zoroaster, and the fire worshippers, who preceded the Greek Prometheus. It has preserved one book, the Zenda-Vesta, the earliest record of Asiatic traditions. The Pari and modern Persian superceded it. It was the language of Babylonian bricks, and of the earliest cuniciform and arrow-headed inscriptions, now unintelligible.

Antiquaries may long dispute whether the Sanscrit, the Zend, the Chinese, or the Alphabet of Taautus, derived from the Hieroglyphics, were the most ancient. The most abstract was the Zend, like our short-hands or digits, the others were derived from sensible objects.

Arrow-headed characters, in which the Zend was written, like hieroglyphics have lost their meaning. They abound as inscriptions at Babylon and Nineveh, and as stamps on bricks in the ruins of Babylon; indeed, they are found in many parts of Western Asia. They are about 40 in number. They were beyond question the written language of Babylonia and Nineveh. They resemble at the first glance Chinese, and there is little doubt that Phœnician and Hebrew were imitations of them.

The Egyptian hieroglyphics were pictures or symbols, their hieratic language was an alphabet derived from the other in relation to the sounds of certain popular objects; therefore, Phonetic and the Demotic was the rude running hand of the hieratic alphabetical, or 29 phonetic letters. Hence, as the Hieratic alphabet was derived from the hieroglyphic, it becomes a key.

There appear, when they are classed, to be only 864 separate hieroglyphic characters, of which 150 were tools, 180 the human figure and limbs, 100 furniture, 60 vegetables, 50 birds, 40 fishes and reptiles, 80 dress, 56 animals, 10 celestial, 20 geometrical figures. Heads are always placed towards the beginning. About 40 or 50 objects are figured. Gods are represented by the animals, or parts of them, sacred to them, or over a man—and. abstract ideas by composition of objects and allegories. Ammon was a man with a ram's head; Phré with the head of a hawk; Anubis with the head of a jackal; Cnuphis with a circle or ram with a feather; an eye, also, represented Osiris; an obelisk, Ammon; or a Nilometer, Phtha. All characteristic to rude analogies.

Hieroglyphics were pictures, and the enchorial (country or popular) mode of writing were brief or rapid marks, generally deduced from the hieroglyphics, and intended to express sounds.

Morrison gives preference to the Chinese characters, as more impressive than alphabetic characters, and refutes the objections raised by the scholars of the west. The Keys of the language are 214, the characters by which others are formed are 3867, or in fact 1903; and from these, by adding an element, the body of the language is formed. 816 mono-syllables form the vernacular tongue.

The modern characters of the Chinese are 30,000; but the works of Confucius con-

tain but 3000. Their great dictionary contains 43,496.—*Marshman.*

Their verbal language is, in principle, like the Welsh, and consists of 330 mono-syllables, which, by accent, are extended to 1300 sounds. The composition of these makes up the colloquial language with a sort of philosophical precision. Its attainment by foreigners is, therefore, not difficult; and though their standard dictionary contains 36,000 words, yet our Todd and Johnson contain 80,000; the Scapula, 44,000 Greek words; and Ainsworth, 45,000 Latin words; independent of inflexions.

The Editor of this volume, in 1804, published a showy edition of the Keys, with an English Commentary by Hager. It led the way to other works, and Chinese is now as accessible as German.

The standard dictionary of the Chinese language, according to Morrison, contains 214 classes; 150 of which include the more important words, and 60 of them about 25,000. The whole was arranged and perfected by Pa-out-she, who lived about 1100 years B. C. Most of the characters are hieroglyphic, or rude representations, like our signs of the zodiac. At present, they are divided into 17 classes, beginning with that formed by 1 stroke, and ending with those formed by 17.

The Chinese is an original language, wholly unlike the Sanscrit or the Hebrew. And the Chinese, in manners, customs, and religion, have no resemblance to any other people. The Chinese, in their Imperial History, refer the invention of fire to the reign of *Swee-gin-shee*, and of iron to the reign of *Fohee*, claiming both as Chinese discoveries. Most of the Greek fables are referable to those oriental discoverers. They were a nation of moralists, and of inventors in all the arts, while Europe was steeped in barbarism.

The Welsh language, always regular and significant in its mono-syllables, consisted of the primitive or radical characters, and 24 secondary ones, formed by cutting letters on a stick in a triangular or square form.

There are 3 primitive languages in Hindoostan, the Sanscrit, Pracrit, and Magadhi. The Sanscrit is the fundamental language, and that of the Vedas. The Pracrit, the vernacular language in many dialects. The Magadhi, or Misra, is that of Ceylon and the Islands.

The current native language of Ireland is, *verbatim et literatim*, that of Carthage, a colony of Phœnicia. Plautus makes Hanno speak in Carthaginian, and "Hann done filli hanum bene filli in mustine," is to a letter Irish, Carthaginian, or Phœnician. All Plautus's other passages correspond also, except in slight variations of some letters in the orthography.

The ancient language of Asia Minor was Phrygian, or Semitic, of which Chaldean, Syriac, Hebrew, Phœnician, and Arabic, were dialects. Beyond the rivers, towards the Indu, dialects of the Sancrit and Zend appeared

The Coptic is an alphabet so called from Coptos, in Egypt, a mixture of Greek and Egyptian.

Hebrew, Chaldaic, Phœnician, Arabic, and Ethiopic, are one family of languages. The Hebrew written character was the Phœnician; but in the captivity, they acquired the square Chaldaic character, and lost the former. Moses is believed to have written only on stone or brass. Papyrus and cloth were not used till after Samuel. To write, was a rare qualification but 500 years ago.

Ethiopic, or Abyssinian, is derived from the Samaritan or Phœnician.

The Etruscan was the first alphabet used in Italy, so called from the Etrusci, the most ancient inhabitants.

The most ancient characters, under the name of Gothic, are attributed to Ulphilas.

Adelung considered the language of Misnia as the standard German.

The most ancient Arabic, called the Kufic, was so named from Kufa, on the Euphrates. The modern Arabic was invented by Mo-lach, A. D. 933, in which he wrote the Koran three times.

Every thing in Europe is modern and imitative, in relation to the history, science, and literature of the Arabians, and the nations that wrote and spoke in Arabic. The Greeks were their servile imitators, and the study of Greece was to visit those countries, and borrow from them. Pythagoras even served in the Chaldaic armies, and Solon, Plato, Anaxagoras, &c. travelled in Arabian countries before they professed wisdom. We also might drink at the fountain, but, by a strange fatuity, we have preferred the muddy stream of Greek and Roman derivation. Scarcely 50 persons in all Europe understand Arabic, but 5000 Greek, and a million Latin, though the Romans merely copied the Greeks, who had mutilated their own eastern originals.

Armenian, used in Armenia, Asia Minor, Syria, Tartary, &c. approaches the Syriac and Greek.

The Malay language, common to all the Oriental islands and coasts, and, in dialects, to the Isles of the Pacific, is softer than the Italian, and totally unlike any other language. Its written character is the Arabic.

The spread of the Arts of Life, or Religion, &c. has assimilated languages. The inventors of gunpowder and the steam-engine transfused new words into every other language. So it has been with writing, metallurgy, printing, horticulture, &c.

Two languages are spoken in Germany, one called Low Deutsch, and the other High German. The former prevails in Westphalia, and on the coasts; the other is spoken in Saxony, Bavaria, &c. and, generally, on the Rhine and Danube. The Low German, or that of the coasts of Friesland, &c., is what has been mis-called Saxon in England, but the language of Saxony always was High German. The Saxon of our scholars is the Teutonic, Teut, Teutsch, Deutsch, or primitive Dutch, not Saxon,

for this Dutch is in no respect Saxon. Language thus corrects a vulgar error. No Saxons came to England! Hengist and Horsa came with bands of Friscians, who used Saxon swords, called *Saxes*, and spoke that low *Deutsch*, which gross ignorance in the age of Vortigern called *Saxon;* and which, credulity and sycophancy call Saxon, even to this day; many Groningen works on this subject are curious, and expose the quackeries of 1000 years.

A Cherokee, named *Sus gue-jah*, about 1820, invented an alphabet of the Cherokee language; and also digits for numbers, to effect the purposes of "the speaking leaf;" but without any knowledge of other characters or digits.

Musicians consider Italian as the vernacular tongue of Etruria and Italy; and Latin as the language of the literati; and they draw the inference from the impossibility of accommodating Latin to music.—*Gardiner.*

Latin smothered the ancient Greek in the middle ages, and produced the Romaic dialect or modern Greek. Greek is to Romaic what Latin is to Italian.

Demetrius Chalcondyles, Emmanuel Moschopulus, Johannes Argyropulus, Theodorus Gaza, and Constantius Lascaris, were the Greeks who fled from Constantinople to Italy and France, in 1452, where Aurispa, Filelfo, and Chrysoloras had already created a taste for Greek literature.

Professor Mezzofanti, of Bologna, living in 1825, spoke 32 living and dead languages. In 1832, he became insane, and mingled all his languages in confusion. Among others, he spoke the Zigan, or Gypsy Tongue, which he described as a dialect of the Pariahs of Hindostan.

In 83 American languages only 170 roots of words are common to both Continents, and three in five of these have Tartar affinity.

The languages of South America have become different, by giving for name to the son, a new word for the name of the object after which his father was called. The object and all its derivations are thus changed in each tribe, and in a few generations the language.—*Dobrizhoffer.*

Smart calculated 20,410 noun substantives in Johnson's Dictionary, 9053 adjectives, 7880 verbs, and 2592 adverbs. Todd and Taylor have increased these full half, making about 60,000 words.

Sheridan reckoned 28 simple sounds, and proposed a new alphabet of 9 vowels and 19 consonants. An alphabet of 13 letters has also been proposed,—the five vowels and the consonants b, g, d, l, m, n, r, s.

Consonants are the beginning or the end of vowel sounds. These are made with the lips open, and the former commence with the opening of the lips, or end with the closing of them.

A bass voice extends from F or G to C or D. A tenor from C to A. The counter-tenor from E to C. The mezzo-soprano from A to F. The soprano from C to C in alt.—*Gardiner.*

A dozen English words end with *a;* two dozen with *o;* and nearly 5000 with *y;* *ough* has 8 sounds, as *up, on, o, off, uff, oo,* and *out.*

During six or seven centuries the Latin tongue prevailed in all public proceedings, from the Tweed to the Euphrates, and from the Danube to Mount Atlas; and the language of the rapacious Roman conquerors has been more or less retained by the servile or monkish classes even to this day.

Adelung, the celebrated German philologer, was born in 1734, and died at Dresden, in 1806. His German Dictionary is the standard of the language. In his general history of languages, he gives specimens of the Lord's Prayer in 500 languages and dialects.

The first writers were the Phœnicians and Egyptians. Taautus, who wrote 8 books of laws, and books of natural philosophy and medicine, lived nearly 2000 years before the Greeks were distinguished. Sanchoniathe must have written before Moses, for he notices nothing Jewish, unless the allies of Ilus or Chronus, whom he called Elohim, after Ilus, were Jews; and we collect from him nothing later than the Titan war, which took place about 2800 B. C.

The Books of Moses were written about 1740 B. C., and other early Jewish books before the year 1200.

The earliest Chinese histories claim the year 2200 B. C.

The Irish chronicles of O'Connor must have been written about 1500 or 1600 B. C.

Confucius, the founder of the religious Deism of China, still professed by the authorities and the literati, was contemporary with Pythagoras, and died at 72. His principles are the Tayhio, the School of Adults; 2, the Chong-yong; 3, the Lung-yu; 4, the Meng-tsi; 5, the Hyanking; and 6, the byan-hyo, or book for children.

Orion was not meant by Job or Amos. The translators so rendered the word Kesil, but without warrantry. The Kimah of Job means the Pleiades.

Pen means high, and *Og* means chief, in many early languages.

The words of Frisic origin in modern English are about 8000 out of 40,000.

Language is first pictorially complete, then symbolical, and then abstract.

Horne Tooke wrote an elaborate work, to prove that our conjunctions are imperatives of Saxon verbs.

If	from Giffan.........	give
An	from Anan	grant
Eke	from Eacan	add
Yet	from Getan	get
Still	from Stellan.........	put
Else	from Alessan	dismiss
Though ..	from Thaffigan	allow
But	from Botan	boot
Without ..	from Worthan-utan	be out
And	from Anandat	
Serve	from Seon...........	see
Lest	from Lessan.........	dismiss

A Welsh etymologist would greatly vary these forced constructions.

Koreish Arabic was that used in the Koran, and is the theological language of all Mahometans; but there is also a vernacular Arabic spoken through Asia, with nouns and verbs the same, but differing in construction in 9 or 10 dialects.

The Arabic minerals were of Hindoo origin.

A Phonetic alphabet refers to the sounds, and was a conversion, by Taautus, of the picture and symbol. Hebrew letters, at first, represented familiar objects, and then analogous sounds for other objects of like sound. Our letters are Phonetic, or the language of the ear. The Chinese is that of the eye. But we, by 30 or 40 sounds, express every idea, and combinations are 10,000, addressed to the eye Our words suggest sounds by habit, but language addressed to the eye is far more vivid and impressive.

Kings and Emperors, in Eastern Africa, are called Ras, a variation of Rajah, Rey, Rex, &c.

The Bedouins and all Levantines use the word *forty* as an indefinite, just like the Hebrews, for many.

The Sanscrit devi or devia, and tri, 2 and 3, is the Welsh dau or dwy, and tri or tair, and the Russian deva and tri. It is nearly the same in other numbers. So the *Sans.* Pitr becomes pater in Latin, vater in German, vader in Frisic, and father in English. And the *Sans* matre, in Welsh, is mathair; in Frisic, moeder; and in English, mother.

In Hebrew, the same word expresses blessing or cursing. To call by names, was to have dominion. Hebrew is mistaken by those ignorant of oriental and national ideas. —*Warburton.*

The Egyptian A is derived from Ahom, an Eagle, whose symbol was A. The Chinese express all manual arts with the symbol for hand, and add a modification.

Al or Allah is Hebrew and Arabic for the Deity. Meus and Deus are Sanscrit. Tooa is used in the South Sea Islands. Mor, mort, or mut, for death, are Phœnician, Sanscrit, Persian, and Otaheitian.

F, V, and W, are convertible in all languages.

Latin construction is as unmusical as it is unnatural, and contrary to nature. Italian was always the vernacular language, and Latin the written and learned language. Its artificial structure proves that it never was a common speech. Saxon is in every respect its superior for every musical purpose.—*Music and Friends.*

The ancients wrote without stops, or even separation of words!

A universal language has been planned, by using the same numbers for the same words in all languages.

The Greek letters, inverted from left to right, are almost identical with the Phœnician or Hebrew.

In early ages, writing and composition were so rare, that vulgar Asiatic feelings attached the notion of sanctity to all that was written.

We are proud, in 1839, of the colonial and commercial diffusion of the English language. But the States of America are already as dialectish as Lancashire or Yorkshire; and, judging from analogy, in 2 or 300 years, either will require a glossary. In 7 or 800 years, both will be as distinct as the language of Alfred from that of the Guelphs. The deviations will be reciprocal. Then, with reference to commerce, we introduce *words*, not our idiom, and do not supplant the language of natives, as old and rooted as the race of man.

The human voice is an instrument which unites the powers of the flute, the violin, and the organ. The lungs are its bellows, the throat and nostrils the pipes, the cavity of the cheeks is the wind-chest, and the flexible parts are the stops. It produces tune, and all the modifications of vowels and consonants.

The trachea, or wind-pipe, branches at bottom to the two lobes of the lungs, and at top ends in the larynx, or rings of cartilages, which are flexible in the glottis or aperture, and thereby vary tones, which the tongue, mouth, and wind-chest articulate.

The zeta, eta, theta, xi, phi, chi, psi, and omega, were added to the first Greek alphabet.

Consonants are stops to the vowels in certain tones.

The invention of conventional signs, characters, or letters, was the first step to that accumulated knowledge which we now find in the world. The first examples were records of regal vanity on stone; then a similar celebration in verse. The next, the regulation of reasoning in logic. The next, the observed motions of the heavenly bodies. The next, arithmetic and geometry. The next, geography, chronology, and history. The next, observations of nature, and the investigation of causes.

The German is the richest, in words, of any European language, owing to the number and power of its roots or mono-syllables.

The Cymri preserve their original language in the Welsh and the Erse dialects; but their followers spread over the continent, even in the tracts now covered by the Baltic, which separated their language into the Germanic and Scandinavian, the first being teutonic, and the latter a derivative. The Germanic is divided between that of the most western settlers who mingled with the Cymri, called Low German, as Dutch, Belgic, and Frisic, and the uncorrupted language called High German.

Rapid speakers pronounce from 7000 to 7500 words per hour, or about 2 words per second.

The Geez, spoken in Abyssinia, &c., is described as a more perfect language than the Arabic. It is usually called Ethiopic, and the Amharic is the modern Abyssinian, and Habbash, the Amharic name of the country.

The Aramean language was that which supplanted the Hebrew and Phœnician, called Syriac and Chaldaic. It was the lan-

guage of Jesus and the apostles. Jesus, on the cross, used the Aramaic version in his exclamation from the beginning of the 22d Psalm, and not the Hebrew original.

The Chinese read in columns from top to bottom of the page, and begin at the right-hand column. Hebrew and Arabic read from right to left. Some Greek inscriptions turn at the end of a line, and the lines alternate from right to left, and left to right. The Europeans read from left to right.

The Turkish is the softest of modern languages for conversation, and adaptation to vocal music.

In German and Spanish, every letter in every word is pronounced uniformly.

The Phœnician, early Greek, Irish, and Icelandic, or Runic, has but 16 letters; others were added for provincial tones.

The Irish alphabet is named after the trees in a wood, as A for Ailm (Elm), B for Beth (Birch), C for Col (Hazel), &c., though perhaps, the trees are only associated for children.

Cæsar's editor says, the Druids wrote in the Greek character; no doubt the Phœnician.

Accent, in words, is believed to arise from emphasis in sentences, compounded into single words.—*Booth.*

The language of the Cape Bushman is a snapping, hissing, grunting, nasal sound.

The German language has 8 vowels, ours 5; and a e for long a, oe for oo, and ue for short i.

Changes of orthography in kindred language arise from the interchange of the Labials p, b, f, v, w, and m, or of the Dentals, or the Palatals, or Gutterals, by different nations.

The languages of Asia have for roots the Hindoo, Hebrew, and Tartarian.—*Jones.*

Sanscrit, the ancient but now learned language of the Bramins, contains very ancient books, called vidas; also, the laws of Menu, and much poetry, particularly 2 epics, the Mahabharata and the Ramayana.

Pali, or Magada, is the learned language of the Boodists, nearly coeval with Sanscrit, and spread theologically through India, China, and Japan.

The Pracrit, or living languages of India, consist of the Hindoostanee, and 7 or 8 other dialects, partly derived from the others.

The Malayan language of the coasts and islands of India, is a perfectly original language, and a key to all intercourse in the Asiatic Seas.

The Tartar languages are the Manshoo, spoken at the Tartar Court of China, and the Mongul and Calmuc, in the dialects of Siberia and Tartary; but without books or learning.

Chinese might be adopted as a universal language, speaking to the eye of all nations like our notes in music, or figures in arithmetic. But, in the notation of number, they preserve forms as impracticable as the Greek and Roman—thus our 22 has = for 2, + for ten, and is = + =.

Certain records may have been inscriptions on stones; but the mummies prove, that the art of writing is far more ancient than the age of Memnon. The use of pigments would be a simple transition from carving, in all countries. Sanchoniatho calls Taautus the secretary of Chronus, who must have lived 3000 years before the Christian era.

The Vidas are most contemptible productions, with nothing to recommend them but their antiquity. Three exhibit all the absurdities of Hindoo paganism, and the 4th is an elementary treatise on astrology, magic, and incantations.

The Phœnician language was that of Carthage, and carried to Ireland by commercial settlers; and the Erse and Manx are dialects.

Hebrew ceased to be vernacular at the Babylonish Captivity; but it was preserved in the books of the Bible, though now a lost tongue. The Jews then spoke Chaldaic and Syriac. Daniel and the Targums of Onkelos, Jonathan and Jerusalem, were written in this dialect. The modern language of the Jews is called Rabbinical Hebrew, and is a compound of Chaldaic and Hebrew, with some Greek and Latin words adopted in Spain about 1100. Hebrew is like our Welsh, first converted into Frisic and Neustrian French, and then into modern English. Modern Hebrew is a compound as unlike ancient Hebrew, as English is unlike Welsh.

Thirty-five radically-distinct tongues are spoken by Mexican Aborigines, but the most ancient is the Hyang-hyung of the *Ot'homi*, who lived in the N. of the great table-land, and built Tolyan and Khilotepek. It is mono-syllabic, and wants our F and L, but it has gutterals in Kh, Ch, N'H, P'H, and K'h. It has no inflections, but by particles, and is as inartificial as the Chinese, which, in all respects, it resembles.—*Vater.*

THE FINE ARTS.

THE Egyptians, as appears by the engravings of Denon, Rossalini, and others, excelled in graphic delineations, and even in colouring. They were mannerists, but their outline was grand. Their works, of course, long preceded the Greeks, who imitated and improved. They engraved too, as appears by the metal tablets found in mummies; and the engraving of hieroglyphics on their granite monuments could not now be imitated.

The earliest recorded Greek painters were Cleanthes and Ardices of Corinth, and they were earlier than Homer. Bularchias, Eumaras, Charmades, Dinias, and Hygiemon, were very early. In the middle period were Apelles, Parrhasius, Zeuxis, Panæus, Polygnotus, Protogenes, Antiphilus, Nicophanes, Nicomachus, Micon, Dionysius, Timanthes, Aristides, and Apollodorus.

The Greeks excelled in sculpture more than in painting, at least we possess their matchless statuary, and it never can be rivalled in every requisite of art. The sculptors met with a patron worthy of themselves

in Pericles; and, in the attainment of all excellence, patronage and genius must go hand in hand.

The most transcendant genius of the middle ages was Michael Angelo Buonarotti, both as painter, sculptor, and architect. In truth, the Italians for many centuries were the artists of all Europe, and they planned and executed every great design.

In our own age, Italy again claimed the palm in Canova, whose works equal those of the classic ages of Greece.

The earliest known painters are Cimabue, Ghirlandao, Massacio, Quintin Matys, and Albert Durer.

The greatest Painters, in order, were Raphael, Michael Angelo, Correggio, Leonardo da Vinci, Titian, Guido, Rubens, Rembrandt, Vandyke, Teniers, Murillo, Carracci, Claude, N. Poussin, and Carlo Dolce.

The principal Painters of the Venetian School were Titian, Giorgione, Paulo Veronese, Tintoret, and Bassano.

The Bolognese School consisted of the Carraccis, Domenichino, and disciples.

The chief Flemish Painters were Rubens, Vandyke, Rembrandt, Teniers, Vangoyen, Ruysdael, and Vandermeer.

The chief Artists of the French School have been Poussin, Claude Lorraine, Le Brun, Vernet, Blondel, and David.

The Founders of the British School were Thornhill, Richardson, Hogarth, Wilson, Gainsborough, Reynolds, Barry, and West.

The English Painters, in the order of genius, are Hogarth, Wilson, Gainsborough, Lawrence, West, Reynolds, Martin, Turner, and Wilkie.

The two great Painters of the Spanish School are Murillo and Velasquez.

The Dutch Painters are Rubens, Van Dyk, Rembrandt, Mierevelt, the Teniers, the Van de Veldes, Jordaans, Cuyp, the Ostades, Gerard Douw, Mieris, the Wouvermans, Metsu, Berehem, Potter, Pynaker, the Ruysdaels, Van Huysem, Wynants, and Steen, all first-rate and unmatched.

The British School has arrived at the highest perfection in every branch of art that is duly patronized. It fails in history, because we have no establishments like Catholic churches, and because Italian pictures may be purchased for private collections at lower prices.

The Italian masters of the 15th and 16th centuries seem to have exhausted the art of expression, and all the first qualities of painting. Vandyke and Lawrence, in Portrait, have maintained the character of the art, and Claude, Poussin, Cuyp, and Ruysdael, in Landscape; but, since their epoch, we have had no M. Angelo, Raffaelle, Correggio, Titian, or Carlo Dolce, unless we except Murillo and Gainsborough.

The Italian Schools of Florence, Rome, Venice, and Lombardy, are the most eminent. The Florentine is characterized by severe and gigantic grandeur. The Roman School is after the antique. The Venetian for its colouring; and the Lombard for its grace, taste, and delicacy.

Michael Angelo, in painting, was an Ode writer or Epic painter; his expression, in every thing, was sublime.

The Dutch School is epi-grammatic.

The Flemish School is distinguished by its knowledge of design and brilliancy of colouring. The Dutch School possessed great harmony of colouring and chiaro-scuro, but lost on low and offensive subjects. The German School has been blended in others, since the age of hardness and dry matter of fact.

The grandest attempt ever made to raise the arts to a pinnacle of perfection, was Napoleon's project to assemble all the scattered master-pieces of painting and sculpture in one collection. This he actually effected, and, for ten or twelve years, the Napoleon Museum, in the Louvre at Paris, was the wonder and admiration of the world. There might be freely seen and studied every famous production of every school, under the liberal direction of that enthusiast in the arts, DENON. The owners of these works had made wanton war on France, and they were made their easy ransom.

The British Government, in imitation of the same idea, and as a School of Art, are, however, proceeding gradually to effect the same object in London. Some fine productions have been liberally purchased, and a superb National Gallery is built for the reception of these, and others that may be procured. Some bequests have been made of great value; and, as the finest works are scattered in English galleries, there is no doubt but another generation will profit by this design.

Penænas, contemporary of Phidias, was the first recorded Greek painter of eminence. He painted the walls of the temples with historical subjects. In sculpture, the statues of Phidias, Mycon, Zeuxis, Polygnotus, Parrhasius, Timanthes, Apollodorus, and Apelles, were executed between 500 and 250 B. C. The Romans did as little for painting as other arts; their remains are frescoes and mosaics, chiefly by Greek artists.

Till about 1400, all painting was in caustic or in water-colours. Cimabue was the first painter in oil-colours; but previously-finished water-colour pictures were washed with oil, and the incorporation gives them the mature appearance of colours first worked in oils.

Some arts of former ages have been lost, as that of engraving on crystal stones and granite, practised by the Ethiopians, Egyptians, &c.; and the art of painting on glass, practised in the monkish ages. Different directions too have been given to the arts, though each is perfect in its way. Chinese art, Japanese art, Hindoo art, are each different from European, which follows the Greek standards in sculpture, and the Italian in painting.

The Egyptians carried the art of matter-of-fact painting, without tints or shades, to the highest perfection.

Painting in fresco, is in water-colours on walls.

Poussin, a devotee of the arts through a

long life, was at once superior as painter and author. He defines painting to be an imitation, in lines and colours, on some superfices of every thing visible, with a view to preserve and please. Light, form, colours, distance, are qualities of objects; and propriety, grace, harmony of colouring, and judgment, belong to the composition and execution.

The Egyptian, Hindoo, and Chinese temples, prove the great antiquity of sculpture; and the rude images found among all uncivilized tribes, prove that the power of sculpturing and carving is universal. Brazen statues, cast from models, were common in all ages.

Dædalus was the first Greek sculptor, and after him sculptors were called Dædalides. The patronage of Pericles raised a Phidias and his sublime school. Polycletus, Myron, Scopas, Praxiteles, and Lysippus, followed, and they and others produced those miracles of art, for which princes and wealthy men give more than their weight in gold.

Sculpture revived, in Italy, in the fancy of decorated plate; and Cellini and others so excelled, that their carvings and castings created artists who restored the art of sculpturing marble. Buono and Pisano flourished in the 13th century, and Robboe and Ghiberti in the 15th, preceded by Donatelli the Venetian, Michael Angelo the Roman, and Leonardo da Vinci. From that time Italy became as famous for sculpture as for painting. The mere names, from that time to Canova, cannot be reprinted; but Canova rivalled even the ancients, and, under the munificent patronage of Napoleon, produced works which never can be surpassed.

Sculptures are produced by mechanical measurements, from models, in any plastic material, by the artist. The reducing the block to a statue is the business of men practised in the use of mallets and chisels. Sometimes, for durable and exposed works, the artist's model is cast in bronze; ordinary busts are cast from the model in plaster of Paris.

Successful landscape includes the perspective of colouring and the perspective of geometry. The latter was little understood till the 17th century, and each were united by Bassano, Claude, Both, and Poussin, and by our Wilson and Turner.

A landscape in perspective should not include more than an angle of 60 degrees, or one-sixth of the horizon. All lines perpendicular to the picture, or perspective plane, vanish in the point of sight, and the size of objects is, therefore, inversely as their distance.

In perspective, we seek to represent the objects on the perspective plane, which plane cuts a cone extending to the objects, of which cone the eye is the vertex. The positions on the plane are, therefore, the *tangents* of the angles of the objects from the point of sight, or centre, on the perspective plane. Of course, the distance of the eye from the plane determines the length of the tangents; and, if we work by a common scale of tangents, we must vary them as the radius of the scale is to the radius or distance of the eye from the plane. But angles of altitude, when the base is fixed in azimuth, must have the radius of the eye multiplied by the secant of the azimuth, and the length set off in the proportion of one radius to the other.

The system of decorating tombs, and ornamenting churches and altars with paintings, kept the art alive, in the dark ages, till the days of the Italian School.

The oldest known painting, since the ancients, is a Madonna and Child, in 886. The oldest known paintings, in England, are the portrait of Chaucer, painted on pannel about 1380, belonging to the Editor, and that of Henry IV. in 1405.

A Cartoon is a pattern for tapestry, &c. painted or drawn upon large paper. There are thirteen by Raffaelle, wonders of art, in our royal collections; and another, the Murder of the Innocents, private property.

Salvator's Pythagoras is at Cobham Hall, bought at a great price, with an annuity of £500 to the seller. Salvator's Death of Regulus was painted for 100 piastres.

Raffaelle's pictures, in their colouring and atmospheric relief, so much resemble nature, that they do not strike in a gallery like others with more glare and relief. It is the same with Correggio, and is the same with all perfect compositions in language; beauties are only discovered by those who know the difficulty of being perfectly natural.

In the Stafford Gallery is a Correggio painted for the sign of an inn. He, and many painters, paid trifling debts with pictures, which the creditor often sold for fifty times the debt.

The Elgin marbles were the sculptures of the Minerva Parthenon and other edifices of the Æropolis of Athens, removed by Lord Elgin at his own cost, and now the property of the British Museum. It was justifiable sacrilege, since the Turks were appropriating them, piecemeal, for building purposes; what could not be brought away entire, were taken in casts and correct drawings.

The Portland Vase, now in the British Museum, cost 1000 guineas. It is Greek, but was found, about 1560, in a sepulchre near Rome. It is 10 inches by 6, and is of glass, with figures in relief, in opaque white, and the ground is dark blue. The figures, as well as those on cameos, were formed by cutting away a crust of white opaque glass. The design is taken from the Eleusinian Mysteries.

The copying and close imitation of the old masters, and the arts so various for giving them the characteristics of age, that seven out of eight pictures are copies. At the same time, artists themselves multiply favorite designs, and one original copy is as good as the first. To meet orders from princes, great painters copied pictures of others, often superior to originals. President West told the Editor that he had, to order, made seven copies of his death of Wolfe, any one of which was equal to his first copy; and so,

said he, it is with all painters. Most painters work second-hand in the masses and grounds; they finish only the delicate parts, chalk out the draperies, and leave the rest to pupils, merely harmonizing the whole.

In ancient statues, the figures are the length of eight or seven heads, or ten faces, and the arms stretched are the same, but half a face less when not stretched. The head, from the top to the chin, is four equal parts: to the forehead, to the eye-brows, to the tip of the nose, and to the tip of the chin. The body is three faces: one to the bottom of the breast, one to the navel, and one to the genitals. The thigh two, and the knee and leg three.

Till a recent period, all sculptures were painted in their natural colours, with gilt ornaments.

The Memnonium was destroyed by Cambyses before it was finished. The statue of Memnon was 64 feet high, and its granitic ruins cover 40 feet around.

Giorgione, in the 16th century, was the first landscape painter.

Albert Durer was, in the arts, a universal genius. He was the best engraver, and a popular author, besides the best painter of his age.

Correggio's master-piece, painted for the Franciscan convent of Correggio, was stolen, in 1638, by a Spanish painter allowed to copy it, and never since heard of; Correggio's price was only 100 ducats.

Teniers is always bright and clear, Hobbima is real day-light, and Cuyp is soft and brilliant.

Albert Durer etched some of his engravings on steel. A soft steel plate will take 50,000 good impressions, and a hard steel plate 1,000,000. The plates in Blair's Preceptor, and Goldsmith's Grammar, have produced above 100,000 impressions, and are still fresh.

Painting in oil, distemper, or water, is when the colours are mixed with oil, size, or water. Fresco is on a newly-plastered wall. Encaustic is with wax; and enamel, with mineral colours, on metal.

Varnish, for oil-painting, is mastich, dissolved in spirits of wine.

The Panorama, invented by Barker, is generally about 60 feet in diameter.

Salvator, disdaining those intrigues by which inferior persons get admitted into all societies, was, when at the heighth of his genius, rejected as a candidate for the *Academia* at Rome.

The Apollo Belvidere, the master-piece of sculpture, was found in a temple at Antium, and for 300 years has stood in the Belvidere of the Vatican. The Apollo Musagetes was found at Tivoli, in 1774.

There are above-ground, at Rome, 10,600 pieces of ancient sculpture, and 6300 ancient columns. In 1500 years, full ten times the number have been destroyed or carried away.

Hogarth's Strolling Actress was bought for 26 guineas, by Beckford, and returned as too dear. The Harlot's Progress, the Rake's Progress, and Four Times a Day, were sold for 22*l*. each. The six of the Marriage a-la-Mode were sold, in 1750, at a *public Auction*, at which only two persons attended, for 110 guineas; but, in 1797, they fetched 1381*l*.; and any single picture of Hogarth's is now worth from 300*l*. to 500*l*.

Miss Linwood's worsted pictures are copies, by the needle, in tints of worsted, of the best known pictures, and are inimitable in effect and accuracy.

In England there are fine works of Canova, at Chatsworth, Grosvenor House, Holland House, &c.; and the Editor possesses his bust of Napoleon, cast in bronze, which formerly adorned the Tuileries.

Michael Angelo was painter, sculptor, and architect. As a painter, he appears in the cieling of the Sistine Chapel, at Rome; his David, Moses, &c. display his sculpture; and the church of St. Peter's his architecture.

Other nations have learnt the art of sculpturing in the Italian School; and Denmark has produced a Thorwaldsen; Wurtemberg a Danneckar; France a Houdon; and England a Bacon, Flaxman, and Chantrey.

The Greek vases have Centaurs of both sexes, and some are depicted in Herculaneum. Phidias sculptured them, and Zeuxis painted them; Hesiod records them. If fabulous, monuments and poetry are worse than useless.

Vandyke usually finished a portrait in the evening of the day he commenced, requiring a long morning and afternoon sitting.

The cupola, at Parma, is Correggio's master-piece.

Age improves, mellows, and harmonizes the tints of pictures, so that they can be fairly compared only after 100 years. Copley, West, and David, will be a school in 1950.

The Italian painters chiefly painted from models in clay, and most of them were at once sculptors and engravers.

The Bayeux tapestry is 442 feet long and 2 broad, representing the invasion and conquest of England.

The Long Parliament ordered all such pictures in the king's collection, as represented the Holy Ghost or the Virgin Mary, to be burnt. The fine Woodstock copy of the Madonna de la Seggia was saved by Col. Fleetwood, the king's secretary, and is now in the possession of Sir Richard Phillips.

Gerard Douw was so attentive to minutiæ, that he employed five days in finishing a hand, and three days on a broom.

Propertia da Rossi, and the Princess Mary daughter of Louis Philippe, were female sculptors of the first rank. The Hon. Mrs. Damer professed, but never excelled.

Torregiano, the sculptor, was exposed in the Inquisition for destroying a Madonna and Child which he had himself produced, but which, as such, were deemed sacred.

Segato, of Florence, reduces to the consistency of stone all kinds of bodies, as birds, limbs, wood, &c. &c. by a process not yet public, but well certified.

The royal portraits the most multiplied,

are those of the vain Elizabeth, Charles I., and Louis XIV. They are incorporated by flattery as saints, angels, gods, and goddesses.

The artist rivals were Michael Angelo and Raffaelle, Titian and Pordenone, Agostino and Annibal Carracci, and Domenichino and Guido.

Carlo Dolci's Madonnas were all portraits of his mistress Maria Baldinucci.

Rubens' Allegories, on the cieling of Whitehall, are considered his master-pieces in colouring, light, and shade.

Roman statues were classed according to their drapery.

The original of Correggio's St. Catharine, with a missal, was bought, in 1801, by the Editor of this Volume, at a sale under an extent.

In France, drawing is a branch of popular education, at very easy cost, and it is deemed necessary to every working artizan. In England there are books calculated to make it general, but it has not yet been generally demanded in elementary schools.

The art of Engraving originated in some experiments of Maso Finiguerra, a Florentine, in the first half of the 15th century. He was an artist who engraved on silver plate; and, being desirous of preserving impressions of his engravings, he took casts in clay, and produced impressions of these, by a roller, in liquid sulphur, and sometimes on damp paper. Then, by engraving in reverse, in the manner of broad seals, he got impressions on paper the right way of the original. The art of block-printing came before the world in the same age, and much resembled the contrivance of the Florentine; for the pages were cut in wood, and then impressed on paper, in the same manner.

Steel engraving is effected by first softening a steel-plate by depriving it of its carbon,—then engraving it,—and finally re-hardening the plate by restoring the carbon. A steel-plate will then take 2 or 300,000 good impressions, while a copper-plate only 12 or 1500. The charge is only 10 per cent. higher.

The Milanese excel in engraving, and next to them the British artists are unrivalled, especially in book ornaments. In large, no engravings equal those of Woollet.

Latterly, a division of labour produces more perfect works, 8 or 10 hands for different parts being employed, so as to confer perfection on each part.

In etching, Albert Durer has left us one of the earliest specimens, dated 1518, and another dated 1524.

That species of engraving which unites *etching* with the use of the *graver*, was, no doubt, adopted immediately after the invention of etching, but Audran was the first who carried it to perfection.

J. C. Le Blon, of Frankfort, pupil of Carlo Maratti, applied mezzotinto engravings to printing with different colours, so as to produce the resemblance of paintings. He considered all colours as composed of three primitive ones; and the combination of two of these, he asserted, would produce a third, such as their compound must necessarily give, and the two primitive colours would preserve their original colour. But, if transparent colours are mixed, and three primitive ones combined together, they destroy each other, and produce a black, or a colour approaching to black.

The earliest prints that are known, are a set of the seven planets, in an almanack, by way of frontispiece.

Our ordinary English Galleries are supplied by four foreigners, Holbein, Vandyke, Lely, and Kneller: and our walls are covered by Verrio, La Guerre, and Thornhill.

The Royal Academy was established in 1768, and consists of a president, 5 professors, 3 secretaries, 37 academicians, 17 associates, and 6 associate engravers. Their annual exhibition contains about 1300 subjects, and yields about £2000 or £2500.

There are Royal Academies at Dublin and Edinburgh; and Associations for Exhibitions at Liverpool, Birmingham, Leeds, &c. &c.

The British Institution for the Fine Arts, in Pall-Mall, was established in 1805.

There are two funds for British artists.

The Academies of Arts are that of Paris, founded in 1663; that of Vienna, 1705; that of Stockholm, 1733; that of Petersburg, 1754; that of London, 1768; that of Turin, 1778; and Madrid, in 1779.

In 1824, the British Government bought the Angerstein Collection for £57,000; including a Sebastiano del Piombo, which cost him £4500, two Claudes £6000, and Vandyke's Theodosius £1600.

Sir Joshua Reynolds' pictures, on the death of his niece, fetched £15,000 by auction.

Walpole enumerates 255 painters in England before George I., of whom 103 were native; none are remembered, except Oliver, Dobson, and Riley.

There were in London, in 1818, painters, 532: sculptors, 45; architects, 149; engravers, 2060: and they are, in 1839, 20 per cent. more.

In 1779, the Empress of Russia gave, by valuation, £40,555 for 232 pictures of the Houghton Gallery; among which Guido's Consultation of the Doctors was valued at £3500, and a Holy Family of Vandyke and a Magdalene of Reubens, at £1600 each.

In 1798, the Orleans Collection was sold for £43,500.

Thornhill had 40s. per square yard for the cupola of St. Paul's.

Charles I. paid Mittens £100 for three portraits, Vandyke £20 and £25 each for several, £100 for a large one, and £444 for nine. He gave £3000 to Rubens for a lot of several.

Nero gave £6800 for Cato's purple robe; Cicero's citron table was sold for £750; the habit which Charles XII. wore at Pultowa was sold for £22,000; the cup of Napoleon was sold for 37 guineas; his Egyptian sabre fetched 15 guineas; and the hat which he wore at Eylau was sold, against 32 bidders, for £75.

This nation is indebted to Slaney, for a plan to form public walks in and near large towns, few of which now possess this cheap luxury. In France, every town has its open boulevard, or broad walk round it, planted with trees; and, in fine evenings, it is provided with the seduction of a local band of music.

Michael Angelo's Moses, Algardi's Attola, Framingo's Susanna, and Bernini's Bibbiana, are the best sculptures in Rome; and Raphael's Transfiguration, Volterra's Descent, Dominichino's Jerome, and Sacchi's Romualdo, the best pictures. There are, also, above 10,000 pieces of ancient sculpture, and above 6000 marble columns.

The busts of Romans have no beards. Most ancient nations allowed their beards to grow only as a sign of mourning. They were generally disused in Christian Europe towards the end of the 17th century.

The Regent of France expended a million of louis-d'ors on his picture gallery. He gave 500*l.* for a picture painted for a sign, by Correggio.

The Tabula Isiaca, 4 ft. 2 in. long, and 2 ft. 6 in. wide, is one of the Egyptian curiosities of Turin.

The recumbent posture of opulent Greeks and Romans at dinner, was called Accubation. They laid 2 or 3 on couches, and fed with their right hand.

LITERATURE.

Literature grows out of the art of composition, in the forms of prose and verse, adopted by writers, and in the subjects treated of. Narrative and argument are its ordinary forms in prose; and metre, and the regular succession of long and short syllables, with or without rhyme, its ordinary forms in poetry. The earliest languages give examples; but, as poetry is best retained, so the oldest preserved compositions are in that form. In prose, the tone is adapted to the subject; but, in poetry, pomposity of diction is preferred, and figures of rhetoric are used to raise the style and imagination. The literature of all nations is, however, evanescent, and depends on the perpetuity of language; consequently, the rise and fall of these arts is generally comprised in 200 or 300 years; after which, authors become intelligible only by glossaries and translations.

The first Greek writers were Homer and Hesiod, 1000 B. C.; and Tyrtæus and Archilocus, in 700: and Alcæus, Sappho, and Anacreon, in 600.

The first Latin writers were Plautus, Ennius, and Terentius, in 200 B. C.

The first British, Gildas, Nennius, and Bede, in 600 and 700 A. C.

The first German, Eginhard, Wallafrid, and Rabanus, in 800 A. C.

The first French, Fort, Gregory, and Maralfe, in 500 A. C.

The first Spanish, Anian, Fulgentius, and Martin, in 500.

The first Polish, Yaraslof and Nestor, in 1000.

The first Italian, Gratian, Falcand, and Campanus, in 1100.

The frogs and mice, the hymns and epigrams, often ascribed to Homer, are not his and doubts are entertained as to the Odyssey; and even the Iliad begins to be considered as an assemblage of fragments or odes, by Homer and other writers. They were, at first, oral and traditional, and not collected till one, two, or three centuries after the alleged age of Homer. They were Ionian, and pictures of action without opinion or sentiment. Pope is a paraphrase; Cowper a translation.

Schlegel considers Solon as giving the first start to Grecian literature.

Thales founded the Ionic school, and his successors were the ever-memorable Anaximander, Anaximenes, and Anaxagoras.

Early Chinese literature suffered a similar misfortune to that of the West, in the destruction of the Alexandrian Library; for their Emperor, Cheewhang-tee, ordered all writings to be destroyed, that every thing might begin anew as from his reign; and their books and records were afterwards recovered with great difficulty. So the Musselmen, conquerors of Hindoostan, destroyed the chief part of the ancient writings.

Antar, an Arabian hero of the sixth century, celebrated for his heroism and romantic love for Ibla, is a poem as much esteemed in Arabia and Egypt as any poem ever was in Europe.

The works of Greek genius descended to us through the Romans, who added themselves so little to human improvement. All the arts and mysteries of the Chaldeans and Egyptians have reached us through the Saracens, to whom we owe our mathematics, arithmetic, medicine, astronomy, chemistry, poetry, &c. These bases have been extended, till our Cyclopædias now baffle the closest labours of the longest life; and yet, such is the vast maze presented to us by nature, that we, of 1839, shall in other centuries be regarded as standing only at the threshold of their Temple of Knowledge.

Books were originally metal plates and boards, or the inner bark of trees, the word being derived from *Bench*, a Beech-Tree. The Horn-Book, now used in nurseries, is a primitive book. Bark is still used by some nations, and skins are also used, for which parchment was substituted. Papyrus, an Egyptian plant, was adopted in that country, and became an article of commerce; thin plates of brass were also used for church service. Papyrus and Parchment *volumes* were commonly rolled on a round stick, with a ball at each end, and the composition began at the centre. These were called volumes, and the outsides were inscribed just as we now letter books.

The Greek MSS. in Herculaneum consist of papyrus, rolled, charred, and matted together by the fire, and are about 9 inches long, and 1, 2, or 3 inches in diameter, each being a volume or separate treatise.

Of course, when books were scarce, and the art of reading uncommon, they were very dear. The bequest of one to a religious house entitled the donor to masses for his soul, and they were commonly chained to their station; while, in some ancient libraries,* the books are chained to this day. As examples of the prices of books, the *Roman de la Rose* was sold for above 30*l.*; and a Homily was exchanged for 200 sheep and 5 quarters of wheat; and they usually fetched double or treble their weight in gold. Then, as books were chiefly religious, so the vulgar annexed ideas of piety to all who read books; those not religious were considered as engendered by the devil, or by an intercourse with evil spirits.

In the east, it is believed that there are not a dozen copies of the Shastah, Vedah, and Zenda Vesta.

In 1400, there was scarcely a book in Rome but missals.

A perfect Livy was in the Grand Seignior's Library, in 1615. High prices were offered for it by ambassadors, but the book soon after disappeared.

Clarke found a MS. copy of Plato in a neglected library of Patmos.

When the passion for reading increased, the business of copying became considerable, and copyers enjoyed reputation, according to their learning and accuracy. Hence they took it on themselves to purge and improve authors; and to this cause may be ascribed the precision and mechanical perfection of the classic authors, for the copyers plumed themselves on not transcribing any imperfections. This advantage was, however, counteracted by the principles which governed them. The first printers were therefore critics, like the copyers.

All rising nations have had a passion for imitating previous ones. Thus Egypt copied Phœnicia; Greece copied Egypt; Rome copied Greek; and modern Europe has copied Rome. In a few hundred years, however, nations set up for themselves, and discard the leading-strings of obsolete languages. The English language is now at maturity; and, hence, Latin and Greek are properly ejected from modern schools, and preserved only by salaries and ancient endowments for teaching them.

Besides the loss of ancient literature by the burning of the Alexandrian Library, by the Christians in 391, and by the Saracens in 640; a nearly equal loss was suffered in the conflagration of the Basilican Library of 36,000 MSS. at Constantinople, in 850.

120,000 Greek MSS. were also burnt at the sacking of Constantinople by the Turks, in 1452. None are now to be traced in the Greek convents. But there can be no doubt that ancient MSS. may yet be found in Eastern countries. Ruppel has lately brought from Nubia a MS. of the Jewish scriptures, with many important additions.

Before the revival of letters, the monks used to sell the parchments on which Greek and Latin works were written, to bookbinders and racket-makers. Some eminent works were rescued by scholars in this way, and others were found rotting in lumber-rooms of monasteries and abbeys. The Popes and Clergy waged war on historians and poets, as profane.

The monks and calligraphists were in the practice of obliterating the previous writing, by a chemical preparation, or of erasing it from silk or flaxen paper, and in this way thousands of valuable MSS. have been lost. Greek dramas, works of Cicero, &c. &c. have been traced under the new writing; and Abbé Mai has collected valuable fragments from Bobbio. Under a trumpery poem he traced three orations of Cicero. Under some acts of a Romish Council, he traced three others, with an ancient commentary; also, eight speeches of Symmachus, and the works of Fronto. Under another, he found fragments of Plautus, and commentaries on Terence; also an oration of Isæus. Finally, he restored a work of Dionysius Halicarnassus, and found 800 lines of a very ancient Iliad.

We are indebted to the Arabians and Saracens for romances and tales, for the numerical character, for astrology and astronomy, for medicine, for chemistry, for commerce, for a language, the most copious in the world, and for the religions that divide the Western world; yet in all ages, except the Saracenic, they have lived in small communities, and have scarcely presented the aspect of civilization.

The first recorded novels are the Milesian Tales of Aristides, which were translated from Greek into Latin by Sisenna, about 60 B. C. They are lost. Nicenus was the next, and forty of his sketches exist. He wrote in the age of Virgil.

The lives of the 3 great Fabulists, Bilpai, Lokman, and Æsop, are involved in equal obscurity as to time and country.

The Romance of Amadis de Gaul was written by Loberia in 1390, and is a romantic poem interesting to our own times.

Du Bartas's Poem on the Creation, written late in the 16th century, and called the Divine Week, was as popular a poem as ever appeared. It ran through 30 French editions, in 5 or 6 months, and was translated into every language.

Bolingbroke was one of the greatest men, and soundest writers.—*Pope.*

Middleton wrote the purest and most elegant English that appeared.—*Wakefield.*

Addison was smooth, but without spirit. Johnson was verbose and pompous. Burke rhetorical, but unequal. Robertson was clear and correct. Gibbon was florid and studied. Hawkesworth, Goldsmith, and Knox, are among the most elegant modern writers. Cobbett was the strongest argumentative writer of any age; and Paine was another example, less varied than Cobbett.

Poetry is the regulated effervescence of the brain. It is part of the excitement which takes place beyond the demands for natural wants, and thus displays itself in flights called imagination, and in eccentricities often productive of personal inconvenience

in the intercourse of life. Good poetry is the able display of feeling; and good prose the able display of fact, correct reasoning, and acquired knowledge.

Bards, among the Druids, were professional poets; and, among all ancient people, such employments were recognized, and connected with religion, rhapsody, prophecy, and music. Among the Jews this class were called Prophets, and their compositions *Prophecyings*. The Greeks called them Ubates; the Romans, Vates; and the Britons, Bards. Ossian speaks of a prince who kept 100 bards. Chief-bards wore sky-blue garments; and, the most distinguished, a silver chain. Even Alexander the Great was accompanied by a bard named Cherylus, who was to have a piece of gold for every good verse, and a blow for every bad one.

Edrisi, the Arabian, who lived about 1100, called his geography, *The going out of a curious man.*

Walter Scott's novels uniformly exhibit a passive hero, who is to marry the heroine; a fierce hero, who is to die a violent death; and a fool, or bore, who is to exhaust his fund of humour. His characters are superior to his plots, his humble to his high life, his Scotland to his England, &c.; his tragedy to his comedy, and his early to his latter works. Novelty among readers, by emphasis called *novel* readers, is so essential, and the supply of new novels, so abundant, that Scott with all his adventitious fame, is already little read, and in half a generation must be nearly forgotten. There is a cold mannerism in his works, a want of abstract truth, and a total want of utility, which destroy their literary importance. The world never beheld such literary gambling, by which a million was got, and a million and a half lost in the short space of 15 years, by Author, Printer, and Publisher.

His co-meteor was Lord Byron, with less factitious display; but, to live among poets, his works must be reduced. A fourth is inimitable, and resembles lightning rather than bursts of mere human power. Nor will posterity fail to remember, that Scott was the pander of courts, while Byron was always constant in his devotion to truth and civil liberty.

The English, and even the improved French versions of *The Arabian Nights*, are miserably defective. A complete version from oriental MSS. has, however, appeared at Breslau, by Habicht, Hagen, and Schall, in 15 vols. 12mo. with new information about their origin. They are referred to the Sultana *Sheherazade*, who told them, as related, to Sultan *Shahriar*; and, after two years and nine months, led him to withdraw his anathema against his wives. The Persians have an imitation in 1001 *days*, but very inferior. Mahomed Ali has Arabic editions for all the schools in Egypt.

As the first literature of all barbarians are the flights of imagination, called poetry, so *The Edda* is a rhapsody of this kind, in three parts. One called the Havamaal, or sublime discourse, is a series of proverbs by *Woden*, who, with his wife *Frea*, are specially consecrated as agents of the Supreme Father, and opposed to *Loke*, the devil, or evil genius, who resides in Hela and Niffheim. From *Woden* and *Frea* come our Wednesday and Friday; from *Loke* our ill-luck; and from *Hela*, our Hell. The third book of this barbarous trash is a system of magic and charms.

Phrenology is not a modern science. A work called *Margarita Philosophica*, published at Friburg, in 1503, contains a skull marked and divided nearly as Gall's. Physiognomy, &c. were subjects treated much at large in the 16th and 17th centuries.

Lope de Vega printed 21 millions of lines, and 800 of his dramas were performed; while he wrote 1800 besides 400 for religious ceremonies. If Lord Holland's beautiful specimens are not improvements, he was the *best*, as well as the most voluminous of poets. His plays make 21 volumes 4to., and his other works 21 volumes.

The first tasteful Russian writer was Lomondsoff, who died in 1765, in distinction.

Chaucer had for contemporary poets, Robert of Gloucester, Robert of Brunne, and Piers Plowman, believed to be a fictitious name. Their predecessors were Kendale, and Thomas of Erceldown.

Hobbes expressed a barbarous wish that all the books in the world were assembled in a ship, and that he might have the opportunity of boring a hole to sink it. Perhaps he would have excepted his own stupid Leviathan, just as the Mahomedan Omar, in his destruction at Alexandria, excepted the rhapsodic Koran. At the same time, it must be confessed, that if we divide books into 10 classes, not more than 1 in 3 or 4 contains an original idea; 5 or 6 are mere appropriations of the ideas of others; and full half are on temporary topics and party questions; while 99 out of 100 are servile panders of received opinions, in which truth, if understood, is compromised to gratify the predilections and prejudices of the age. In large books which involve much capital, the first object, and anxious care, are to please, and avoid offence to small thinkers, so as to secure a return with profit.

Our Alfred was an Author, and left some books of useful information in the barbarous Frisic (called Saxon) which as yet have been imperfectly edited. Henry the VIIIth. was another Royal Author, but on the heated theological questions of the day, and deservedly forgotten. Elizabeth wrote some poetry and short pieces. James I. was a superstitious pedant who wrote 2 folios in defence of the reality of witches, demonology, &c., and against the use of tobacco! The Royalists, after the Restoration, tried to prove that Charles I. wrote Bishop Gaudon's ingenious Forgery of *Icon Basilike*. James wrote on kingly rights; and George III. wrote many essays and pamphlets; one published for him by the Editor of this volume, was on the fulfilment of the Revelations. George IV. also published, through the Editor, a folio on the Herculaneum MSS.

Akenside, our classical British poet, left the world the following analysis of the merits and qualities of great poets :—

	Critical Ordonnance.	Pathetic Ordonnance.	Dramatic Expression.	Incidental Expression.	Taste.	Colouring.	Versification.	Moral.	Final Estimate.
Ariosto........	—	15	10	15	14	15	16	10	13
Boileau....... ..	18	16	12	14	17	14	13	16	12
Cervantes......	17	17	15	17	12	16	—	16	14
Corneille	15	16	16	16	16	14	12	16	14
Dante	12	15	8	17	12	15	14	14	13
Euripides......	15	16	14	17	13	14	—	15	12
Homer	18	17	18	15	16	16	18	17	18
Horace	12	12	10	16	17	17	16	14	13
Lucretius......	14	5	—	17	17	14	16	—	10
Milton	17	15	15	17	18	18	17	18	17
Moliere	15	17	17	17	15	16	—	16	14
Pindar	10	10	—	17	17	16	—	17	13
Pope	16	17	12	17	16	15	15	17	13
Racine	17	16	15	15	17	13	12	15	13
Shakspeare	—	18	18	18	10	17	10	18	18
Sophocles......	18	16	15	15	16	14	—	16	13
Spenser	8	15	10	16	17	17	17	17	14
Tasso	17	14	14	13	12	13	16	13	12
Terence	18	12	10	12	17	14	—	16	10
Virgil	17	10	17	17	18	17	17	17	16

The estimates stand thus :—

CRITICAL ORDONNANCE.

First Class. Homer, Sophocles, Terence, Boileau.
Second. Virgil, Tasso, Milton, Racine.
Third. Pope.
Fourth. Euripides, Corneille.
Fifth. Lucretius.
Sixth. Horace, Dante.
Seventh. Pindar.
Eighth. Spenser.

PATHETIC ORDONNANCE.

First Class. Shakspeare.
Second. Homer.
Third. Sophocles, Euripides, Corneille, Racine.
Fourth. Dante, Ariosto, Spenser, Milton.
Fifth. Tasso.
Sixth. Terence, Horace.
Seventh. Pindar, Virgil.

DRAMATIC EXPRESSION.

First Class. Homer and Shakspeare.
Second. Virgil.
Third. Corneille.
Fourth. Sophocles, Milton, Racine.
Fifth. Euripides, Tasso.
Sixth. Boileau, Pope.
Seventh. Terence, Horace, Ariosto, Spenser.

INCIDENTAL EXPRESSION.

First Class. Shakspeare.
Second. Euripides, Pindar, Lucretius, Virgil, Dante, Milton, Pope.
Third. Horace, Spenser, Corneille.
Fourth Class. Homer, Sophocles, Ariosto, Racine.
Fifth. Boileau.
Sixth. Tasso.
Seventh. Terence.

TASTE.

First Class. Virgil, Milton.
Second. Pindar, Terence, Lucretius, Horace, Spenser, Boileau, Racine.
Third. Homer, Sophocles, Corneille, Pope.
Fourth. Ariosto.
Fifth. Euripides.
Sixth. Dante and Tasso.
Seventh. Shakspeare.

COLOURING.

First Class. Milton.
Second. Virgil, Horace, Shakspeare, Spenser.
Third. Homer, Pindar.
Fourth. Dante, Ariosto, Pope.
Fifth. Euripides, Sophocles, Terence, Lucretius, Corneille, Boileau.
Sixth. Tasso, Racine.

VERSIFICATION.

First Class. Homer.
Second. Virgil, Spenser, Milton.
Third. Lucretius, Horace, Tasso, Ariosto.
Fourth. Pope.
Fifth. Dante.
Sixth. Boileau.
Seventh. Corneille, Racine.
Eighth. Shakspeare.

Sophocles, Euripides, Pindar, and Terence, are not numbered.

MORAL.	
First Class.	Shakspeare, Milton.
Second.	Homer, Pindar, Virgil, Spenser, Pope.
Third.	Sophocles, Terence, Corneille, Boileau.
Fourth.	Euripides, Racine.
Fifth.	Horace, Dante.
Sixth.	Tasso.
Seventh.	Ariosto.

FINAL ESTIMATE.	
First Class.	Homer, Shakspeare.
Second.	Milton.
Third.	Virgil.
Fourth.	Corneille, Spenser.
Fifth.	Pindar, Sophocles, Horace, Dante, Ariosto, Racine, Pope.
Sixth.	Euripides, Tasso, Boileau.
Seventh.	Terence, Lucretius.

Galileo used to say, that reading Tasso after Ariosto, was like eating cucumbers after melon.

Since Akenside we have had Burns, Byron, Cowper, Wolcot, Crabbe, Moore, and Wordsworth, to add to the previous analysis. France and Germany have also made additions in Delille, Goëthe, Klopstock, and Schiller, &c. &c.

Pope was 6 years translating the Iliad, by which he got 6000*l.*; *i. e.* 200*l.* per vol. from Lintot, and the proceeds from 575 subscribers. Lintot then gave him 600*l.* for the Odyssey, and the subscriptions. Dryden was 3 years on the Ænead, and got 1200*l.* for it.—*Spence.*

Monti and Pindemonti have been the best Italian poets of the last age, and are compared to Dante and Petrarch. Maffei and Visconti, fine writers; Galvani and Volta, their philosophers; and Canova, their master sculptor.

The Provençal poets were Chaucer's originals.—*Pope.*

Dryden and the Wits met at Will's, at the corner of Bow and Russell-streets; and, after his death, Addison established Button's, at the opposite corner of Charles-street.

Politian was the best modern Latin poet.

Aperient medicines, as salts, improve the fancy and vigour of mind.

Tasso and Ariosto are equally popular in Italy.

Dante is the Italian Homer. His work was called Comedia, in contrast with Virgil.

Petrarca and Chiabrera are the best lyric poets of Italy.

Boileau was, and perhaps is, the first French poet. Voltaire and Delille next.

Pope Nicholas the Fifth was the patron of the Greeks, who revived learning.

Shakspeare's is a stiff, and Milton's an unnatural exotic style.—*Pope.*

The power of *improvisioning* in Tuscany is an intellectual miracle.—*Spence.*

Sir Isaac Newton, on being asked his opinion of poetry, replied, that it was a kind of ingenious nonsense.—*Spence.*

Pope and Boileau are deemed the best modern poets, but Pope will live the longest.

Chaucer, Spenser, Milton, Dryden, and Pope, are the recognized poets of Britain. Byron might be added. Butler, Donne, Churchill, and Wolcot, are our best satirists.

The golden era of Turkish poetry was the reign of Bajazet the First. All the early sultans were patrons of literature, and Mahomet II was an accomplished scholar. The Janizaries alone were the enemies of learning; but, since their extinction, the printing-press has been introduced.

Spenser was born in East Smithfield, Pope in Lombard-street, Gray in Cornhill, Chaucer and Milton in Bread-street.

Pope translated the Iliad in a tower at Stanton Harcourt, near Oxford. His Essay on Man, he wrote in a little room adjoining the Thames, at the back of Lord Bolingbroke's, at Battersea.

Professor Babbage has published an affecting volume, on the Decline of Science in England, and the fact is undoubted. All study has reference, he says, to commercial profit, or mere show; while increasing societies are sustained by subscribers and amateurs, not by philosophers, the ratio varying from 50 and 30 to 1. Students in mathematics, the bases of all exact knowledge, have diminished within a century from thousands to tens. In regard to societies, the system of ballot excludes original thinkers and improvers of knowledge, and reduces the new members to obscure conformists and genteel adulators.

Since the general spread of education, light reading has swamped sound literature by the high profits and patronage of one, and the low patronage of the other. A successful novel or eccentric work is, therefore, a fortune to its author, while sound literature seldom pays the expense of printing. The result is a general preference of the more profitable, and a supply of variety, which begets a seeming public taste. Light reading sustains, also, about 2500 circulating libraries.

Royal societies, and associations of aristocratic *amateurs*, have as pernicious an influence on the advance of improvement almost as the schools of the middle ages. They countenance no originality, and originality never seeks them. They parrot within them what is discovered without them; and they recognise improvements only after the second or third generation.

Professor Cooper, in speaking of the very low state of knowledge in America, observes, "that silly poetry, novels, romances, and newspapers, with theological tracts, manufactured to impose on credulity, are plentifully distributed; while law and medical books, as tools of trade, are often reprinted; but there is no knowledge for its own sake, and education and study have every where a pecuniary reference. Even in seminaries of education, appointments too often depend on the struggles of the ambi-

tious bigots of contending sects, and all colleges, except one or two, are sectarian. Congress, by heavily taxing foreign books, have exposed the people to reprints of Byron's poems and Scott's novels; but, in this law, the ignorance of the community has been faithfully represented."

England is the only country in which books are advertised, and this expense adds 30 per cent. to the price. In France, two copies are sent to about 20 journals, and their notice is the sole advertisement, besides the public voice. In England, the public voice is surrendered to advertisements and puffs in every form, aided by mock corrupt criticisms.

Colonists are grossly abused by the exporters of books, and the ignorance of merchants; and they get few books but such as are mere waste paper in England. The merchant usually orders *a case of books*, of 100*l.* or 500*l.* value, forgetting that there are books of every variety of intrinsic worth; and then the dealer avails himself of this inadvertency, and fills the case or cases with none but such books as few ever saw in England, and which can generally be bought at the price of waste paper. Fine binding is the chief feature of books thus sent abroad.

The decline of literature, in England, has been accelerated, or caused by a passion for novel reading, which, by absorbing patronage, deprives all other studies of their reward. It resembles the Roman literature in the decline of the empire; and, for some years past, few books but novels have paid their expenses. A good novel yields its author from 300*l* to 1500*l.*; while Dr. Johnson's high price for his Dictionary was but 1575*l.* A novel, written in two months, will yield its author 300*l.* or 500*l.* as a current speculation.

The fame of most writers is very ephemeral, chiefly owing to their choice of subjects of the day, or of the age or nation. English literature does not preserve above 8 or 10 authors before the age of Shakspeare; not above 20 from Shakspeare to Addison, and scarcely 50 from the age of Addison to the year 1839. Since the days of Elizabeth, one or two books, or pamphlets, per day, have been printed; but the subjects were obsolete theology, forgotten politics, or superseded philosophy, and the majority in bad method or bad taste. It has been the same in France, Germany, Italy, and Holland; and, doubtless, was the same among the ancients, though we so often lament the loss of ancient works.

It is subject matter only, and original ideas, independent of theories and fancies, that assures fame, not flippant time-serving works, or such as humour the taste of the day. The only permanent associations are those connected with nature, not in speculations, but in novel facts. On this account, Aristotle and the ancient astronomers live with their subjects. Nothing has a chance of permanent fame, which does not gratify human nature, whether Chinese, Hindoo, Turkish, Russian, &c. &c., for every nation passes through the mental phases of all.

In fact, all literary idolatry is very unfavourable to emulation and improvement. Great geniuses, in any line, swamp others for a century.

Authors are commonly in distress, because they begin without capital, and are obliged to anticipate the results.

The slavish admiration and imitation of the ancients, and of all predecessors, is unfavourable to future exertions, and injurious to succeeding ages.—*Schlegel.*

Since the Hanoverian succession, literature and literary men have been cruelly neglected; and, since the establishment of the very useless eleemosynary Literary Fund, the nobility have entirely withdrawn their once-efficient support from men of letters. The penny and twopenny publications of scraps and extracts have also left original anthors without hope.

Reviews of books, under the false pretence and colour of criticism, are usually written by the friends or enemies of authors, or of the publishers of the works, and are trading frauds, which delude the ignorant. No such opinions ought to have any authority, without the known name of a responsible critic. Nevertheless, a malignant spirit in readers, who often delight in slander, occasions the most vituperative anonymous criticisms to be the most read and patronized.

Owing to the difficulty of finding critics on special subjects, it often happens that the same person writes critiques on the same book for many reviews, and a single writer has been known to write seven or more at a profit of 50*l.* or 60*l.* So also a critic who obtains possession of an expensive book, earns ten times its price by variation in criticisms for many reviews. Newspaper critiques are always paid for, and then quoted as real characters of the work. Commonly, on very peculiar subjects, the author is solicited to become his own reviewer, or he prepares reviews, and offers them, free of charge, to different reviewers. Frequently, the book is never seen, but a common-place article is written on the *subject* from the advertisement. At least a hundred writers subsist, in London, by jobbing for reviews, and by bribery arising out of their influence on ignorant readers and a deluded public.

The literary education of women began to prevail in the early part of the 17th century. Till then, few were taught more than to read, but writing was then superadded with music, dancing, and French. In 1620, neither of Shakspeare's daughters could write. The change wrought changes in literature. To provide books for female readers, novels were contrived; and, owing to women having leisure, they were multiplied; and, since 1780, have so grown in number, and commercial importance, as almost to supercede all other books, and render them but secondary, in profit, to authors or publishers.

The *Bibliomania*, like the Tulip-mania in Holland, became too ridiculous to last.

It was finally written down by Dibdin. They valued books in the inverse ratio of their intrinsic worth, and any peculiarity, even a printer's blunder in a copy, raised its value 500 per cent. First editions, with all their imperfections, were often worth a freehold estate, and a dealer was in danger of ruin if a second copy, by chance, came into the market; and all this took place while current literature languished, and hundreds of able writers were starving.

London reading may be judged by the fact, that, in 3 parishes of Westminster, of 101,000 inhabitants, there are 38 small libraries, containing each about 550 volumes of novels, romances, and other trash, and 15 large ones, stocked in nearly the same manner. The current amusements of London and large cities are fatal to extensive intellectuality.

The Shah Nameh, an heroic poem, by Abul Kasim Ferdousi, consists of 60,000 verses of great force and matchless beauty, written between the years 960 and 1000. It comprises Persian history from Kaiomurs, the first sovereign, to Yesdigerd the Third, when Persia, in 641, was overrun by the Arabs or Saracens. He wrote it by desire of Sultan Mahmood, who was to give him a piece of *gold* for every verse, and then sent him with true royal honesty 60,000 pieces of *silver*, and persecuted him to death for resenting the fraud. His poem begins with Kaiomers, the Adam of the Magi, and the Alorus or Orion of the Chaldeans.

It is not to be dissembled that Milton's Paradise Lost, with all his absurd machinery of devils, angels, &c., yields in our days to common sense, and though his admirers are many, his readers are few.

The Greek anthology of epigram, epitaphs, and light pieces, even in elegant English, is very trifling and pointless, and, at best, only pretty. They are far excelled by fugitive modern verse, though Sappho, Anacreon, Alcæus, Menander, Meleager, &c. have a factitious fame, maintained by pedants and critics. Even Merivale's taste will not raise them, and they could have been admired only when books were rare.

We learn from Bland, that even genius did not protect the Greek and Latin poets from violent or premature deaths; as in the instances of Sappho, Anacreon, Theocritus, Euripides, Heraclitus, Hesiod, Æschylus, Æsop, Lucretius, Seneca, Lucan, Menander, Terence, Cratinus, Petronius, Socrates, Demosthenes, and, finally, Cicero.

Reinaert de Vos, or Reynard the Fox, a satirical poem, written about 1250, by Willem Van Utenhoven, a priest of Aerdenburg, was for centuries the most popular work ever written. It was translated into many languages, and into English by Chaucer.

As there is no excellence without emulation, and no emulation without reward and distinction, so in the Arabs' courts of criticism, the best poem of the year was written in letters of gold and suspended in the temple of the Caaba. These works of the ages, when the northern nations were devastating Europe, are distinguished by the purity and eloquence characteristic of Arabic.

The Caliph Al-Mansur set an example of literary patronage, which, to his glory, was carried to the highest pitch by his successor Al-Mamun, whose reign was the triumph of literature and philosophy, and the golden age of their professors.

Painters, poets, and dramatists, have done as much as priests, to give currency to gross superstitions. Poets and painters want subjects beyond nature, to strike the imagination and satisfy their flights of power, and dramatists seek to attract by the terrible and incomprehensible. Who can doubt that there are demons, who behold Michael Angelo's Last Judgment, or read Paradise Lost, or Dante's Inferno, and see Shakspeare's Macbeth or Hamlet?

Pankouke's Encyclopédie Methodique was in 255 quarto volumes, of which 36 were plates only. Every subject was separate.

The Nautical Almanac, the *Connaissance des Temps*, and the *Astronomishes Iahrbuch* of Berlin, have all the same objects. Regiomontanus made the first Almanack, in 1474.

The largest impressions of any single book were those of Moore's Almanack; a proof of the prevalence of superstition. For many years, during the late wars, when political excitement was excessive, the Stationers' Company sold from 420 to 480 thousand copies per annum, of Moore's Astrological Prophecying Almanack. About 50 years since, the Company resolved no longer to administer to this gross credulity, and, for two or three years, omitted the predictions, when the sale fell off one half.

Gilles de Retz, or Laval, was the original Blue Beard of Perault. He resided at Machecoul in Brittany, and was a marshal of France. He was charged with murdering several wives, and above 100 children, and with sorcery, and was burnt at Nantes, Dec. 1440.

The term *Blue Stocking*, applied to literary ladies, was conferred on a society which was called the Blue Stocking Club, in which females were admitted; and so called, owing to a Mr. Benjamin Stillingfleet, one of its acting members, wearing blue stockings.

The first edition of Paradise Lost, in 4to., was sold at 3*s*. in plain binding.

The sale of the Spectator was above 3000 per day; Tickell says, sometimes 20,000. It was ruined by a half-penny stamp, which raised the price from 1*d*. to 2*d*.

The Tatler was commenced in 1709, the Spectator in 1711, the Guardian and Englishman in 1713, the Freeholder in 1715, the Rambler in 1750, the Adventurer in 1752, the World 1753, the Connoisseur 1754, the Idler 1758, the Observer 1786. They appeared two or three times a week, in foolscap folio.

Dillitanti are a species of *small literati*, who speculate on small points of taste and criticism. They write Essays, Sonnets, and Novels, and are a sort of literary gossips.

Nine-tenths of what are called men of letters and genius are of this class.

Cyclopædias are national and temporary works, adapted to the faith, self-love, and prejudices of the nation and age for which they are written and manufactured. Thus, an English Cyclopædia is science Anglicized, a Scotch one subjects all knowledge to a Scottish standard, and a French one refers all wisdom to Frenchmen. In all such works every nation sees itself under an angle of 180°, its military and intellectual heroes fill 100°, its local objects 50°, and all the world only the other 30°.

Ana are maxims, anecdotes, and original fragments of eminent men. The French have a multitude of such works, of which specimens were translated by the Rev. Ph. Smith. In England we have Walpoliana, by Pinkerton; Addisonia, Swiftiana, and Brookiana, by Wilson; besides Oxoniana, by Walker; and Londiniana, by Brayley; all original and curious.

The idols, or false divinities, exposed by Bacon, he called Idola Tribus, Idola Specus, Idola Fori, Idola Theatri, and they are as much worshipped at this day in the Universities and Royal Societies of Europe as in the days of Bacon; while they are zealously upheld by the servility of the press.

The Scotch are industrious collectors, but nationality so blinds them, that they refer most improvements and inventions to Scotchmen. In 2 modern Scotch works in names quoted, there are 1876 references to Scotchmen, 324 to Englishmen, 7 to Irishmen, 104 to Frenchmen, and 125 to Germans, Italians, &c.

The French Romance of Jehan de Saintre, written in 1459, contains the most accurate picture of the absurdities of chivalry in the cause of religion, the female sex, and a morbid sense of honour.

Shakspeare's Romeo was Romeo Monteccheo, and Juliet was Juliet Capello. Bandello gives the story as true; and, till lately, their tomb was shewn at Verona.

The *Contes des Fées*, in 50 or 60 vols., were the production of the Countess D'Aunoy, who lived from 1650 to 1705. Few of them have appeared in English.

The Vedas, or Laws of Menu, addressed to a civilized people, were edited by Kullnea, about 880 B. C. The hero Rama lived between 1176 and 940 B. C. The war between the Pandoos and the Kooroos was in 580 B. C. Alexander defeated Porus in 317 B. C., and, from that time till 1000 A. C., little is recorded of Hindoo history.

The brain has no innate or pre-existing ideas, but it has powers which limit its own energies and laws, by which it acts, in the use of its experience and fixed sensations.

Logicians teach five rules of conception, or perfect reflection, as follows :—

1. Conceive of things *clearly* and *distinctly* in their own natures.
2. Conceive of things *completely* in all their parts.
3. Conceive of things *comprehensively*, in all their properties and relations.
4. Conceive of things *extensively* in all their kinds.
5. Conceive of things *orderly*, or in a correct method.

Hence every perfect idea includes clearness, completeness, comprehensiveness, extent, and system or order.

Prose style is merely a picture of an author's tone of thinking. In general, it is the succession of ideas as they progress in the brain; and the best words are those which, in their usual sense, exactly express the idea, and no other.

Logic was the chief study of the middle ages, but its abuse led to its neglect, and it is now abandoned, to the prejudice of sound learning. Euclid is preferred as a praxis, but being a dry pursuit, both logic and Euclid are improperly abandoned.

The moderns are superior to the ancients, only in living later, and in having accumulated more facts.

Aristotle and all the Greeks insisted on the importance of collecting Facts, and from them forming general inductions and axioms.

The ancients divided knowledge into Arithmetic, Geometry, and Dialectics. To these the moderns have added Experiment; but our public schools retain the ancient division, and instead of Experiment, the real modern improvement, have added the dead languages, in which two-thirds of all studious time is wasted.

The developement of talent takes place from 30 to 45.

Aristotle's philosophical works were his 8 books of Lectures, his 4 on the Heavens, and his 2 on Production and Destruction. He also wrote on Meteorology and Mechanics, on Natural History, Colours, and Sound.

The most eminent Arabic philosophers have been Al Farabi, Ben Sina or Avicenna, Al Gazali, Ben Baja or Avenplace, Ben Roshd or Averroes. They had, also, 8 or 10 great mathematicians, and 40 or 50 eminent historians, whose mere names are scarcely known in Europe. In fact, under suitable patronage, they had able writers on every subject, many of which require translation.

Scott's Waverley was offered, anonymously, to the Editor of this Volume. The price asked for it was refused. It then appeared as *W. Scott's*; but in a few days the name and placards were withdrawn, and the author said to be *unknown*.

Junius was the production of the two brothers Maclean, and Eden, afterwards Lord Auckland.

All the elementary books under the names of Blair, Goldsmith, Barrow, Pelham, and Bossut, were the productions of the Editor of this Volume, between 1798 and 1815.

A self-student reads only for sense, a student under a master only for words.

Esculapius, according to Sanchoniatho, was the father of medicine; while Thoth, his contemporary, had great celebrity for his knowledge of the secret virtues of herbs. The second Pharoah had also great reputation in this way.

Medicine, at first, was intimately mingled

with astrology; the horoscope of the time of consultation indicated the disease, and the antidotes were herbs, whose qualities were also indicated by the moon and planets.

All this was Phœnician and Asiatic; also Egyptian, Chaldaic, and probably still more eastern. The Greeks, 1500 years after, affected the same knowledge, but mingled it with fables and absurdities.

To this day the astrological physician sets a figure or horoscope, to determine whether the patient will recover, and the remedies.

Dr. Royle shews that medicine, as a science, was of extreme antiquity in India. The Ayur Veda, in Sanscrit, gives details which leave little of discovery to the moderns. Their anatomy, in all its branches, is perfect, and they seem to have been familiar with our latest discoveries in surgery and pharmacy, and even to have had 127 surgical instruments; yet the Ayur Veda was composed in unknown time, before Budha, Zoroaster, and Confucius. The Egyptians, Arabs, Greeks, and Romans, were right, therefore, in their homage to the East. Dr. Royle finds, too, in their early Geometry, the 47th Prop. of I. Euclid, and other theorems, long supposed to be Greek or modern.

Astrology is an error, because it connects certainties with mere probabilities. For example, no astrologer views the heavens in making predictions, but merely consults an ephemeris, for it seldom happens that half the planets are above the horizon, and, if so, no eye could fix their positions. Nor is the erection of an horoscope of the twelve hours, or equal divisions, an affair of calculation, but it is formed in a few minutes, by brief tables.

The line of demarcation, in the History of Philosophy, is drawn by the belief in gratuitous and fanciful causes. Paracelsus, Von Helmet, Dee, Kepler, Brahe, Bacon, &c. believed in witchcraft, demonology, and astrology, and form one obsolete set; while their successors, Newton, Halley, Cavallo, Cavendish, &c. &c. believed in the mutual attractions and repulsions of inert matter, a faith which governs all their reasonings, and vitiates all their writings. The next age, we may hope, will investigate all the proximate means by which the motions of atoms and bodies produce phenomena, and we may then hope that Philosophy will become a rational study, and supersede literary trifling.

Metaphysics fail, because they assume results and relative effects as absolute principles of nature. They reason about *educated* man, instead of referring to the *infant* man; and then adopt, as natural principles, all that has been superadded by the constant energies of his own microcosm, and the re-actions of external objects. Gassendi, Locke, &c. alone are right, in maintaining that there are no innate ideas; and the novel doctrine that time is the succession of motion, and is merely our perception of the succession, is fatal to full half of metaphysical philosophy.

A mode of action, which cannot be explained, is a visionary basis of any theory; and an assertion that it is inscrutable, is as impudent as it is ignorant. What is assumed, without proof, may not be true, and then all the inferences are false. Thus, unavowed intentions, or assumed consequences, ought not to be ascribed to any antagonist. It is a bad use of the *argumentum ad hominum*.

The progress of medical science is best proved by the epochs of certain professors.

Esculapius was of the consecrated family of the age of Taautus, about 2900 B. C.

Hippocrates flourished in the 4th and 5th centuries B. C., and had Eudoxus for contemporary.

Asclepiades, Dioscorides, and Euphorbus, were of the century B. C.

Galen died at 70, in 200 A. C.

Avicenna died in the 10th century, in the reign of Canute.

Linacre, Glauber, Paracelsus, and Nostrodamus, in the 15th century.

Harvey, Sanctorius, Cæsalpinus, Eutsalius, Fallopius, &c. in the16th century.

Willis, Sydenham, Malpighi, Ruch, Bartholin, J. Gregory, Cavalieris, in the 17th.

Mead, Hoffman, Ellmuller, Friend, Pitcairne, Boerhaave, Hales, and Sloane, between the 17th and 18th.

W. Hunter, J. Hunter, Cullen, Fothergill, Brown, Cheyne, Pott, Whytt, Bell, and Bonnet, in the 18th.

Jenner, Withering, Home, Cline, Currie, Petit, Desault, Vaughan, and Halford, in the 19th.

The Dutch Heins is known as Heinsius, Schryver as Schriverius, Gronof as Gronovius, and Vos as Vossius.

To protect authors, the act of Anne permitted them to assign leases of *only* 14 years, when their property, for their future provision, reverted to them. But, by a gross blunder of legislation, they were, in 1814, empowered to grant leases for 28 years, by which the entire object of copyright law, as to authors, was totally defeated. The first was a law passed under the influence of an administration of men of genius; the last under the Goths and Vandals, who misruled from 1765 to 1830.

The relations of an author and publisher are exactly those of a proprietor, who grants a lease for a fine. The shorter the lease the oftener the fine is receivable. The law for the encouragement of learning, passed by the sages in the age of Anne, provided, therefore, as a security to authors against themselves, a short lease of 14 years, and "*no longer;*" but, by a climax of absurdity, the Bœotian parliament of 1814 extended the term to 28 years.

The acts relating to copyrights are:—

Books, 54th George III. c. 156. Assignment 28 years, and if the author survive, during his life. *Engravings*, 7th Geo. III. c. 38, for 28 years. *Sculpture*, 54th Geo. III. c. 56, for 14 years. The crown has the copyright of the Bible and Common Prayer-book, the Statutes, and some Latin books.

Five copies of new works are, by 6 and 7 William IV., to be delivered to public libraries.

PRINTING.

The art of Printing has changed the mind of man and the face of society. MSS., till its general usage, were scarce, dear, and inaccessible to 999 in every thousand; and, those in existence, taught very little. In fact, learning to read was very useless, except to the professions; and learning to write was still more useless. Such was the state of man till after the year 1450; but the printing press created new and unforeseen excitement, and, towards 1500, schools were everywhere established to read the printed books. Intellectual pursuits and improvements of all kind followed; the man of the 17th century was as much advanced over the man of the 14th, as this latter was superior to ordinary animals. Printing, in fact, generated a sixth sense, and raised man and society above half in the scale of intellect.

Without printing there could have been no Reformation. It was this art that gave wings to the doctrines of the Reformers. Fifty Luthers, before Martin, had been extinguished by fire and faggot, but these could not overtake the radiation of the printing-press. It was a new power conferred on human nature, to check the insolence of kingcraft and priestcraft. This great contest in 400 years has effected much, but the struggle may last 200 years longer.

We are grossly deceived if the same art had not been practised, by the Chinese, 1000 years previously. They did not, however, change blocks into types. It is possible that some eastern traveller may have made the suggestion to Koster and Guttenburgh. About the same time the Portuguese were exploring the East, and this Chinese art, through them, might have reached Holland.

The Germans assign the invention of printing to Gensfleisch, our Guttenburgh, of Mentz. The Dutch are equally tenacious about Koster, of Haarlem.

KOSTER, LAURENS JANSZOON, born in 1370, was a citizen and the treasurer of Haarlem, where he invented printing, and, about 1422, produced a book called *Spiegel onser Behoudenesse*, or Mirrror of our Redemption. It is a quarto, in old German character, printed on one side, and the blank sides pasted together. The pages are without folios, and many of the letters do not range in line. Its object was to illustrate Scripture by woodcuts.—*Bosworth.*

The first printed books were trifling Hymns and Psalters, with images of saints; and, being printed only on one side, the leaves were pasted back to back. One of the first was the Biblia Pauperum, of 40 leaves, which, pasted together, made 20.

An entire Psalter was printed, in 1457, by Faust and Schoeffer; and a Bible, in 637 leaves, in *moveable types*, was printed at Mentz, between 1450 and 1455.

Of course, moveable types were invented between 1422 and 1450, but by whom is not ascertained, though the only original part of the invention.

The first printing characters were Gothic; but Roman type was used in 1467.

The first printed sheets were produced by a plane and mallet. The old ordinary printing-press was first made by Bleau, at Amsterdam.

In thirty years after the invention of printing, about 1450, the popes took alarm, and printed lists of forbidden works, and required others to be licensed, by three friars, under pain of excommunication, fine, &c. Till then, writing and printing were free. The presses of Cologne, Mentz, Treves, and Magdeburg, were specially interdicted.

Copying was, in ancient Greece and Rome a productive employment; but it afterwards fell into the hands of the monks, who copied chiefly theology. A good copy of the Bible, on vellum, employed two years; and the works of either of the Fathers still more time. Jerome states, that he had ruined himself in buying a copy of the Works of Origen. Of course, copiers altered and vitiated, corrected the language, interpolated, &c. according to their honesty, taste, faith, or party; and hence the endless controversies, among critics and theologians, about words, phrases, and paragraphs. It thus appeared, that, at the Council of Nice, in 325, there were 200 varied versions of the adopted Evangelists, and 54 several Gospels.

Whether we have reached the *ne plus ultra* of the art cannot be determined; but what has been done has filled the world with books, journals, and newspapers, and every head with more knowledge than was possessed by whole colleges of learning 4 or 500 years ago! Of this the MILLION OF FACTS, and all its power of spreading, at a low cost, every kind of knowledge, is a notable example. The MS. of such a volume would, in 1440, have cost 500*l.* currency; and the work in 1839 is offered to the public for a few shillings of modern currency.

Caxton was the first English printer, and his printing-office was in the Chapter-house of Westminster Abbey. He learnt the art in Germany, and was liberally patronized in England. The first book printed by Caxton was in 1471, and bore for its title "*Willyam Caxton's Recuyel of the Historyes of Troye, by Raoul le Fevre.*" While the Bibliomania prevailed, a copy was sold by auction for 1060*l.* 18*s.*

After Caxton's death, printing was practised by his foreign assistants, Wynkin de Worde, Richard Pynson, John Lettoic, and William Machlinia, whose worthless books sell, as curiosities, at high prices.

In England, the first types were cast by Caslon, in 1720. The printing-machine was suggested by Nicholson, in 1790, and perfected by Koenig.

Stereotype-printing was used in Holland, early in the last century. The rollers for inking the types were the suggestion also of Nicholson. Stereotype-printing was introduced into London, by Wilson, in 1804. The last-adopted improvements have been the Stanhope press, the Columbian press, and

the printing-machine, worked either by steam or hand.

Stereotype forms of a Bible, in 4to., exist at Leyden, from which impressions have been taken since 1711. At Haarlem, also, is another stereotype form of a Dutch Bible, which dates in 1705. John Muller, minister of a German church at Leyden, contrived, about 1701, this method of printing.

Printing was distinguished by little taste or susceptibility of improvement, till Baskerville and Bell, about 1776, who were followed by Bulmer, Bensley, Savage, &c.

In the English alphabet, 22 of the capitals are perfect squares. I and J are upright parallelograms, and M and W are one-third wider than the heighth. The hair strokes at the tops and bottoms progress equal to the thick line. The small letters are half the heighth of the capitals. The tails of p, q, &c. descend as much as d, b. &c. ascend.

A sheet of type employs about 120 lbs. weight, or 60 lbs. to a form. The proportions in founts, as of 100,000 letters, in English, would be 5000 a; 3000 c; 11.000 e; 6000 i; 2000 m; and of k. q, x, and z, not above 30. Antimony, alloyed with lead, makes types.

The French reckon 2000 to an edition, the English and Germans 750, and the United States 1000. If 750 of a new book in England cost 250*l.*, the same in France would cost but 120*l.*, and in Germany and the United States but 100*l.* In England, advertizing is 20 per cent. of the cost; in France, &c. but 5 per cent.

A volume of 20 sheets costs, in Germany, for 1000, or two reams, per sheet, 16*l.* 10*s.* for paper, and 13*l.* 10*s.* for printing; other expences various. The same volume in England would cost 42*l.* for paper, and 42*l.* for printing, besides advertising 25*l.* *i. e.* 110*l.* instead of 30*l.*, taking engraving, author, &c. as equal in each country.

The modern names of sizes of books are derived from the folding of paper; when the sheet is not folded it is called a folio, and this size was very fashionable through the 16th and 17th centuries. The folio sheet, doubled, becomes a quarto, and this has been thought the most convenient form; another double constitutes the octavo, of 8 leaves, or 16 pages; another double, the square 16mo. The sheet folded into 12 leaves is called a duodecimo; into 18 an octodecimo or 18mo; and then, doubled again, becomes a 24mo. or 36mo.

A ream of paper is 18 quires, of 24 sheets, and 2 quires of outsides, of about 20 torn sheets. But a printer's ream is 21½ perfect quires, or 516 sheets, usually producing 510 or 512 books.

The duty on paper is now 1½*d.* per lb., and a perfect ream of printing demy paper, of 21½ quires, or 516 sheets, weighs from 18 to 24 lbs.

500 of an octavo volume, of 512 pages, cost 131*l.* in boards: 750 cost 158*l.*; and 1000 cost 187*l.*; independently of advertising, from 40*l.* to 80*l.*, author's premium, and engravings. 500 of a pamphlet costs 20*l.* paper and print. 4000 of the Monthly Magazine, in 18.6, cost 60*l.* paper and 40*l.* printing, besides 25*l.* or 30*l.* for sundry expences, per number.

Printing, valuable as the art is, has been unfavorable to the perfection of modern books. An author prints a large edition, and often has no opportunity of correcting; but every copy was an edition to an ancient author, and he had as many opportunities of revising, as there were copies made. This explains the precision of the classic authors, which again would be increased by the taste of learned copiers in after-ages.

The utility of printing, as far as regards the progress of *truth*, is also counteracted by the great expence of setting the types; for, as all books sell best which flatter prevailing opinions and support vested interests, and as they are printed chiefly at the risk of traders, who look to sale and profit, so few (very few) printed books contain the whole truth, and nothing but the truth.

Causes which *limit* the social benefits of printing merit notice. One is the power of anonymous and irresponsible publications, by which sophistry and bad passions enjoy undue power; another is the expence, by which poor students and original thinkers are shut out from the world, and a third is the commerce in books, in which gain is the sole object, with an utter disregard of truth or falsehood. Half the sheets, printed and puffed into ephemeral notice, are written for base purposes; sometimes sordid, as in trading criticisms; at other times venal, as in newspapers; and often to promote the interest of some craft. The expence subjects truth and knowledge to the chances of the lottery of wealth. Commercial objects raise and perpetuate only fashionable and agreeable opinions, so that folly appears in splendid forms, while wisdom and originality are either suppressed, or make humble and uninviting appearances.

The largest editions are of ephemeral theological tracts, printed in sectarian connexions, and forced on congregations for profit. They die with the year, and are mysteries except to the initiated. Similar connexions also force magazines into sale, and the profits go to a fund for the benefit of ministers, to whom, in portraits and in puffs, they are a monthly "Vanity fair." Half the printing performed, and half the money spent in books, has some relation to this debasing trash.

Books and paper were formerly sold only at stalls; and the dealers, therefore, were called *Stationers*.

We have a variety of reading publics: 1. The readers of newspapers only. 2. The readers of magazines, journals, and reviews. 3. Readers of sectarian and enthusiastic tracts. 4. The exclusive readers of novels and tales. 5. The readers of amusing literature. And 6, the students in the sciences. In 1839, the 1st and 3d are 1,000,000 each; the 2d, 50,000; the 4th, 100,000, the 5th, 10,000; and the 6th about 1000.

About 1774, a system of paying printing

compositors per 1000 letters was first established. Previous to 1785, the price per 1000 letters was 4*d.*; in that year it was advanced to 4½*d.* In December, 1800, the price was increased to 5¼*d.*; and, in 1810, to 6*d.* In 1816, a distinction was made by the masters between manuscripts and reprints; *reprint* works are now paid 5½*d.*, and manuscript 6*d.* per 1000. Hands on day-work receive from 30*s.* to 36*s.* per week, and the daily papers pay about 2*l.* The average earnings of the whole printers' trade (not including newspapers) are about 30*s.* per week. In addition to the price per 1000 letters, there are additional charges,—for notes at the sides and bottoms of the pages, tabular statements, foreign languages, law works, parliamentary work, &c.; and, when manuscripts are badly written, an extra charge is allowed.

The means in use among the Chinese, for producing an impression of letters, appear to be nearly the same with those invented in the infancy of the art. Blocks of hard wood, or masses of metal, forming a kind of stereotype, are printed from, by a very simple and expeditious process, and solely by manual labour, as presses for the purpose are entirely unknown. The Canton Gazette, a kind of court-journal of appointments, arrivals, and departures, is one of the few publications which are printed from moveable types. The blocks which are mostly used for engraving these stereotypes upon, are made of a hard and well-seasoned wood, divided into slabs, in the direction of the grain. The subject to be engraved is carefully written or drawn on thin paper, and pasted reversed upon the board; the wood is then cut from around the characters, and the letters remain in low relief. The appurtenances of a printer are very simple and cheap, and the operations less complicated than almost any other mechanical process. The board or slab of wood is placed on a table before the workman, and a pile of dry paper cut to the proper size, at his side; when, with a rude bamboo brush, a coating of liquid Indian ink is put upon it.

There are, in London, about 2000 compositors, 500 apprentices, and 1000 pressmen, besides machine-hands.

℔ 1000	Various-sized Types.	Lines to 12 inches.
10*d.*	Diamond	205
8*d.*	Pearl	178
7½*d.*	Ruby	166
7*d.*	Nonpareil	143
6½*d.*	Minion	128
6*d.*	Brevier	112½
6*d.*	Bourgeois	102½
6*d.*	Long Primer.......	89
6*d.*	Small Pica.........	83
6*d.*	Pica...............	71½
6*d.*	English	64

Pressmen are usually paid from 9*d.* to 1*s.* 4*d.* for every 250 impressions, according to the size of the paper, and the care required.

PUBLIC SOCIETIES AND LIBRARIES.

Italy had, in the 15th century, so many associations, like our societies, called Academies, that there were 550 for general or particular pursuits. The French imitated the Italians in the 16th and 17th centuries; and, in the 17th and 18th, the English imitated both, in the Royal and other Societies; and of late they have been so extended, as, perhaps, to equal the Italian societies in number. They spread knowledge, but they subdue original thinking by deference to existing authorities. In Italy, therefore, no new discoveries are traceable to them; and, in England, distinction in our numerous ones consists in merely knowing the current knowledge repeated in books.

In general, literary and philosophical societies are mere close corporations, and very unfavourable to originality and the advance of knowledge, beyond a prescribed beaten track. They are usually governed by the prejudices of the education of the senior members; and, hence, having a certain weight with the vulgar, they always impede the march of discovery. They help to spread what was known when they were founded; but they look with stern jealousy on all innovations.

There are Royal Academies of History, Antiquities, Belles Lettres, and Language in Italy, France, and Austria. France has also an Academy of Architecture and Dancing. It is, however, a very striking fact, that every great discovery has been made by solitary persons, who usually have been opposed, and often persecuted, by academies and associations.

SITES OF LONDON SOCIETIES.

Royal Society, Somerset House.
Antiquaries Society, Somerset House.
Geological Society, Somerset House.
Linnæan Society, Soho Square.
Horticultural Society, 21, Regent Street.
Royal Medical and Chirurgical Society, 53, Berner's Street.
Civil Engineers' Society, 1, Cannon Row.
Society of Arts, Adelphi.
Graphic, Thatched House, St. James St.
Royal Society, Literature, St. Martin's Pl.
Zoological Society, 28, Leicester Square.
Royal Institution, Albemarle Street.
Royal Asiatic Society, 14, Grafton Street.
Royal Geographical Society, 21, Regent Street.
British Architects' Society, 16, Lower Grosvenor Street.
Entomological Society, 17, Old Bond St.
Statistical Society, 4, St. Martin's Place.
Royal Astronomical Society, Somerset House.
Medico-Botanical Society, 32, Sackville St.
Numismatic Society, 24, Dover St. Picca.
Ornithological Society, 57, Pall Mall.
London Institution, Finsbury Circus.

The following is a list of the principal Literary Societies in the United Kingdom, with the fee on admission, according to Babbage, and the initial letters distinguishing the members:—

Royal Society, 50*l*., F.R.S.
Royal Society of Edinburgh, 25*l*. 4*s*., F.R.S.E.
Royal Academy of Dublin, 26*l*. 5*s*., M.R.I.A.
Royal Society, Literary, 36*l*. 15*s*., F.R.L.
Antiquarian Society, 50*l*. 8*s*., F.A.S.
Linnæan Society, 36*l*., F.L.S.
Geological Society, 34*l*. 13*s*., F.G.S.
Astronomical Society, 25*l*. 4*s*., M.A.S.
Zoological Society, 26*l*. 5*s*., F.Z.S.
Royal Institution, 50*l*., M.R.S.
Royal Asiatic Society, 31*l*. 10*s*., F.R.A.S.
Horticultural Society, 48*l*. 6*s*., F.H.S.
Medico Botanical, 21*l*., F.M.B.S.

In 1827, only 109 of the 1150 F.R.S. had contributed to the Transactions; and, of these, 11 only had titles of rank.

Among the 1000 or 1100 men, who, by fashion, or vanity, are fellows of the London Royal Society, there seldom are above a dozen to whom science is a pursuit, and not more than 1 or 2 that affect originality.

The greatest PUBLIC LIBRARIES contain as under:—

Name.	Vols.	MSS.	Prints.
Bib. Royale, Paris	630,000	80,000	1,400,000
Vatican, Rome -	600,000	40,000	500,000
Ditto, Munich - -	540,000	16,000	300,000
Bib. Im., Petersb.	132,000	12,000	250,000
Bib. Roy., Copen. -	110,000	15,000	80,000
Bib. Imp., Vienna -	284,000	16,000	300,000
Bib. Roy., Berlin -	280,000	5,000	180,000
Bib. Imp., Pekin -	80,000	*Unk.*	
Bib. Roy., Dresden	260,000	3,000	250,000
Brit. Mus., London	280,000	25,000	85,000
Bodleian, Oxford	250,000	25,000	
University, Gottin.	240,000	5,000	40,000
Bib. Ducal, Wolfenbuttel - - -	200,000	4,500	80,000
Bib. Roy., Madrid -	200,000	18,000	100,000

Libraries of above 100,000 volumes are those of the Arsenal at Paris, the Royal Stuttgart, Milan, Naples, Florence (two Libraries), Breslau, University of Munich, the Advocates at Edinburgh, Venice, Turin, Sion College, London University, Cambridge, Trinity College, Oxford Colleges, Dublin, Amsterdam, and Bologna.

Each of them, besides, contains thousands of unbound tracts; some half a million.

The 3 or 4 American Libraries do not yet exceed 50,000 volumes.

There are, in the United Kingdom, 112 public libraries, or collections of books and records.

All the first and second-rate towns of the United Kingdom have fixed libraries, sustained by 50, 100, or 300 subscribers, at one or two pounds per annum, with a premium on admission. London has seven or eight, with from 300 to 600 subscribers. They buy the new books and journals, and usually have newspapers. When not governed by theological or political partizans, they are eminently useful and agreeable. The first were formed in the great towns, about 60 years ago, and there are now at least 500.

Another species of convenient literary establishment, a centu y old, is the circulating Book Society, formed by 20, 30, or 40 subscribers, who, after a fixed number of days, forward the books from one to another, in a rota, fixed by their facility of communication. A secretary, usually a bookseller, puts them in circulation, and receives them again, and once a year they are sold at a dinner of the members, and the produce expended in new books. The subscriptions vary from 15*s*. to 30*s*., and of such associations there are at least 1000.

There are also some minor associations, for theological and professional books. Novels, tales, &c. are chiefly read through about 1500 circulating libraries, by the volume or year.

In the Southern counties of Scotland, there are itinerating libraries, invented by Samuel Brown. When a library has been read by a village, it is exchanged with that of another village, and their variety of books given to both. There is a head station to a given number of libraries thus circulated, and to which each returns every two years for reparation, &c. Each library is about 50 volumes, and with its case costs 12*l*.

It is all these institutions, and the circulation of newspapers and journals, that has created the new and useful power in society, which our statesmen call the spirit of the age, and to which, legislation and public policy are obliged to succomb.

The British Association is a practical means of bringing the science of universities and societies before the public. But, as the committees of management consist exclusively of professors, and men of orthodox opinions, so there cannot be, and is not, that free display of opinions which is essential to the republic of letters. A daily programme of each class fixes the proceedings, and spontaneous displays are far from being encouraged. The system is, no doubt, useful to a certain extent, and perhaps it could not be better.

The Paris cabinet of maps contains 1½ million, and those of Vienna, Munich, and Dresden, about 300,000 each. The British Museum above 10,000.

The Editor of this volume suggested the first idea of the Diffusion Society to Dr. Birkbeck, and then, by his advice, to Lord Brougham, early in 1825. His idea was that of a fund, for vending or giving away books and tracts, like the Religious Tract Society; and not to set up a commercial chartered company for literary monopoly.

The BRITISH MUSEUM, now of free access to the public, contains the greatest assemblage of natural specimens, geographical curiosities, ancient works of art, books, and MSS., ever assembled in any country. The species of animals of the three kingdoms, and of minerals, are classed systematically, and labelled; and, in like manner, works of art, of Egypt, Persia, Asia Minor, Greece, Rome, ancient Britain, &c. &c. There are 16 rooms on the ground-floor, filled with books and MSS., besides the Royal Library of

George III., in a noble room built for its reception. There are 13 rooms on the upper floor, for sundry curiosities in art and natural history, besides the long gallery, containing 70 glazed cases of specimens of minerals and fossils. There are 12 rooms for archæological curiosities and ancient sculpture, besides 4 saloons for special collections. And there is a medal room for numismatic curiosities, and a room for costly and rare engravings. Nothing of its kind can be more complete, and for public gratification better managed. There are, besides, spacious reading rooms, with easy access, and every facility afforded for the inspection of every literary curiosity. A cheap general catalogue is a guide, and there are enlarged catalogues by able men of every department, for the use of students and scholars.

The Library of *the British Museum* is one of the most extensive in Europe, both in printed books, MSS., and prints. Among the MSS. is a copy of the Old and New Testament, in four volumes, written by a lady of the name of Thecla, at Alexandria, in the fourth or fifth century. Also, a Latin copy of the Gospels of the eighth century. The Antiques and Egyptian Reliques are splendid.

R. P. Knight gave 5205 valuable Greek coins lately to the British Museum. The Rev. W. H. Carr 35 ancient pictures. And — White, Esq. 30,000*l.* to build a library.

The Royal Library, presented in 1822 to the British Museum, consisted of 65,250 books, besides pamphlets. The previous Museum Library was 110,000 volumes, consisting of Sloane's, Harley's, Hargrave's, Burney's, and Banks's Libraries, besides Lansdowne MSS. &c.

The British Museum, in 1838, expended 27,000*l.* in purchases and various expences.

The VATICAN LIBRARY was founded by Nicholas V., and rebuilt by Sixtus V. in 1588. Christiana, Queen of Sweden, enriched it with 1900 MSS., among which were the Theodosian Code, and 18 folios of her letters. It contains 2 ancient MS. Codices of Virgil, 1 of the third century, also a Terence. Petrarch's Epigrams in his MS. It is 1000 feet long, with one Gallery of 800, and one of 200.

The LAURENTIAN LIBRARY, at Florence, was founded by Cosmo de Medici, and contains 10,000 curious MSS.

The AMBROSIAN LIBRARY, at Milan, contains 40,000 MSS., among which are a Josephus of the fourth century. Manuscripts of Thomas Aquinas, Leonardo da Vinci, Petrarch's copy of Virgil, &c. &c.

The St. Mark Library, at Venice, was founded in 1306. It contains Petrarch's Greek MSS. and Library, and Pinelli's MSS.

The *Bibliotheque Royale*, at Paris, was founded with only 20 books, in 1340. It has since been increased to 80,000 MSS., (many most curious) above half a million of volumes, besides 5000 volumes of engravings.

The Imperial Library, at Vienna, contains 300,000 books, 12,000 MSS., and half a million of engravings; among which are MSS. of the fifth century, and copies of most of the first printed books.

The Vienna Library contains 12,000 *Incunables*, or Books, printed before 1500.

The Escurial Library is rich in Hebrew and Arabic MSS., among which are the Codex Aureus. The titles are on the edges.

The Stutgard Library is chiefly remarkable for editions of the Jewish Histories, of which there are full 7000, in 50 languages.

The Copenhagen library is very extensive, containing many MSS., and those of Tycho Brahe.

The *Bodleian Library*, at Oxford, was founded by Humphrey, Duke of Gloucester, about 1435, but afterwards dispersed. It was restored in 1597, by Sir Thomas Bodley, at his own cost, and has been enriched by splendid donations. It now contains 250,000 printed volumes, and 25,000 MSS.

The *Lambeth Library* has many rare books of divinity, and contains a fine copy of the Koran.

Bennet College Library, Cambridge, contains the MSS. &c. found in the monasteries at the Reformation, and extremely curious, and in Teutonic or Deutsh. Other libraries at Cambridge abound in curiosities, as MSS. of Newton, Milton, &c. The Codex Bezæ of the fifth century.

All the College libraries at Oxford, Cambridge, Dublin, Glasgow, &c., abound in reliques and curiosities. The *Chapter House*, Westminster, contains the original Domesday Book. Lord Spencer at Althorp, the Marquis of Stafford, the Duke of Marlborough, and others of the English and European nobility, also have extensive collections, and many rare books and MSS.

The Advocates' library, at Edinburgh, contains 100,000 volumes, besides ancient MSS., and a cabinet of scarce medals.

We call the Mahomedans barbarous, but the Caliphs patronized the Arts and Sciences as much as Pericles. The Fatamite Sultans collected 2,600,000 books, which were respected by Saladin. The present Sultan is a fine writer and patron of letters.

Lord Auckland, the Governor General, has established a concourse of men of science at Calcutta, on the plan of the British Association. At the first meeting, on Nov. 8, 1836, Dr. O'Shaughnessy exhibited his invention of a machine to travel by electro-magnetic excitement. Mr. Prinsep also exhibited new magnetic phenomena.

Jeddo and Miako, in Japan, have, according to Balbi, Libraries of 150,000 volumes, and he estimates the ancient Libraries of Alexandria, Trajan, Tripoli, Cairo, and Cordova, at 110 000 or 100 000 rolls or books each.

1250 new books, in 1500 volumes, appeared in Great Britain in 1838.

Of 100 new books printed, 70 do not pay the expences of printing, paper, and advertizing. Of the remaining 30, not more than 15 realize a fair profit. Of these, 5 are re printed, and 2 or 3 maintain a demand for a few years. About 1 in 200 are in demand for 14 years, 1 in 500 for 28 years.

and 1 in 1000 live to the next generation. Not above a score survive of the 50,000 printed in the 17th century; nor above 80 or 100 of the 70,000 printed in the 18th century. The loss on 8 or 900 books printed in the United Kingdom in a year, is not less than 40,000*l.*, and the first cost is about 120,000*l.* Vanity in authors, and ambition in publishers, are leaders of false speculation.

The book trade in England has suffered in its returns from cheap publications and compilations; and from associations which disregard the profits which were heretofore redisbursed to authors of *original* works, by speculating publishers.

100 new books, per annum, were printed between the Restoration and Revolution.

About 60 new works, per month, have appeared within a century in the United Kingdom, one half theology and romances.

The record commissioners, for reprinting ancient MSS., records, &c. in the public offices, have expended in 20 years 546,000*l.* in printing 1,000 copies of sundry works, for which the demand is so little, that scarcely the odd 6,000*l.* has been received for sales.

Books are a lottery, with three or four blanks to a small prize, and 500 blanks to a capital prize. Hence a publisher labours like Sysiphus. The 18th century enabled few publishers, in England, to realize. The Tonson family became opulent through a patent for 100 years, to supply the public offices with stationery! Miller left 20,000*l.*, Lintot, 6,000*l.*, Cadell, 30,000*l.*, chiefly derived from other sources. Dodsley, 7,000*l.* in 30 years; Dilly, 30,000*l.* in 50 years; Johnson, 25,000*l.* in 45 years. But Hodges, Coote, Harrison, Crowther, Evans, Robinson, &c. &c. died insolvent.

English literature enjoys an immense advantage in its monthly fair or magazine day. Parcels of these and other books are then sent from Paternoster-Row, &c. to full 3000 trading correspondents, each of them invoiced from 5*l.* to 10*l.* In France, journals and new books are sent by post, at one penny per journal, and a few pence per 100 miles for new books, but this deprives the local trade of the circulation, and literature of the incidental advantages of the monthly market.

1260 trade-tickets, for legitimate booksellers in London, were issued from 1830; and it is believed there are not less than 1600 dealers in books in and round London. There are also about 25 in every English county, and 12 in every Welsh, Scotch, and Irish. In all, about 2500 out of London.

It is difficult, in any country, to discriminate the really new works, owing to their mixture with new editions, their re-announcements, &c.

In France, above 150 new works appear per month; and in Germany, about 300. The French publishers have the benefit of their universal language, and the German of the 2 Leipsic fairs, where editions are carried off by exchanges among printers from all the States.

The United States produce about 100 new works and re-prints per month, and the numbers increase. Not above 1 in 100 reach Europe, nor above one in 500 is re-printed.

The various papers and returns printed annually for Parliament, are nearly a million copies, and about a fifth are sold.

France produced 5500 new works in 1836, of which 1800 were on science and art.

Between Caxton 1471 and 1600, about 10,000 books, pamphlets, and single sheets, were printed in England, and not a dozen are known to the year 1840.

20,000 religious and political tracts were published between 1640 and 1660.

In France, the copy-right of an author lasts for his life, and to his family ten years after his death. In the United States, it is fourteen years, and then reverts to the author for a second fourteen, as it ought.

In Germany, there are 1094 booksellers, with sales of a million sterling.

Three thousand new works, in five millions of volumes, are brought forth at each of the two Leipsic fairs, in editions from 1000 to 3000. The new authors are 1000 at each. In the year 1814, the number of new works was but 2500; but, in 1834, it exceeded 6000. The stocks on hand are enormous. An annual Book-fair, in London, would greatly benefit the booksellers of the United Kingdom, and our literature generally.

The whole book trade in Germany centres at Leipsic, and all writing and publications have reference to its Easter fair, for there and then the whole trade is supplied by an agent. John Otto, of Narnberg, was the first speculator in copywrights, and soon after he had two imitators at Leipsic. The first Easter catalogue was published in 1600, and regularly since. It is now a large closely-printed volume of new books, and new editions. Copyright does not extend to all the States, and therefore original German books are cheaply printed to prevent piracies, while copy money is low, since all superior works are pirated.

Every MS. in Austria is submitted to 2 censors, and sometimes 3, before it can be printed.

The history of China to the conquest of the Mongols in 1644, forms 300 volumes. They have a biography in 120 volumes, a Cyclopædia in 240 volumes, a dramatic collection in 200 volumes, and a civil code in 261 volumes. An imperial edition of standard works extend to 168,000 volumes in the time of Kien-lung. Between them and Europeans there are wonderful differences, but no general inferiority!

JOURNALS, NEWSPAPERS, &c.

Periodical distribution of newspapers and journals is differently managed in England and on the Continent. In England there are intermediate dealers, who distribute and give credit; but, on the Continent, owing to free distribution by post, the purchaser and publisher are in contact, and hence, for want of intermediate capital, the former pays in advance, as a subscriber for a term. In England, one or any number of a work can be

bought; but, on the Continent, the publisher prints only for subscribers. Freedom in this, as in all things, answers best. Post-office distribution in England is plausible, but it *would greatly interfere with those useful local marts, the shops of country booksellers, owing to whose perennial exertions the trade in books is ten times greater in England than in France.*

In 1712, the annual number of British newspapers was 15,000,000; but in 1753, owing to stamp duties, they fell to 7,500,000; in 1760, they were 9,500,000; in 1790, were 14,000,000; and, in 1792, 15,000,000. In 1840, they approximate 100 millions.

The Gentleman's Magazine, at first, was a mere reprint of essays from the newspapers. The Monthly Magazine, in 1796, was the first original expansion of the plan of magazines. Since then, they have degenerated into squibs and tales. Reviews are mere advertisements of the books of their proprietors, in the plausible form of pretended criticisms. The first regular one appeared in 1749, and was imitated from the French *Journal des Sçavans*, but always corrupt in management.

In 1782, England had but 79 newspapers. It now has 439.

North America, in the year 1720, possessed no more than seven newspapers: but, in 1839, the United States had 800; 250 twice a week, and 75 daily.

A London morning paper employs from 60 to 80 persons. Their machines perfect 2000 papers per hour, *i. e.* eight tokens, or ordinary hours' work at the usual printing-press. Eight or ten reporters relieve each other, every hour, during parliamentary debates; and 24 to 30 compositers set slip by slip, as copy arrives, and the papers are on sale often within two hours after speeches have been delivered. A large paper contains about 360,000 distinct letters and spaces. An expert compositor picks up 1200 letters in an hour.

The 80,000,000 of newspapers, sold annually in England, consume 162,000 reams of paper. These 439 several publications give constant employment to ten persons on each, as editors, printers, publishers, &c. &c. In London, about two-thirds of the matter in each is printed from MS.; in the country, about two-thirds is transferred from the London and other papers.

The largest Sunday papers contain seven columns per page, and are 24½ inches long, by 19½ wide, containing 480 square inches per page. The four pages contain, therefore, 1920 square inches, and every square inch, on the average, 32 words! Hence, this surprising sheet contains above 60,000 words, sold for 5*d.*, or 3000 words for every farthing.

The word *Gazette* was derived from the name of the small Venetian coin, which was the price of the first newspaper. The London Gazette was commenced at Oxford, on November 7, 166?; the Court then residing there on account of the plague.

There are, in Paris, above 152 journals, literary and religious, and 17 political. One hundred and fifty are liberal, having 197,000 subscribers: and the other 19 have 21,000. There are 75 provincial journals, with 99,000 subscribers. In all 244, with 317,000 subscribers. Owing to subscriptions being annual, the numbers do not vary much.

Besides its intolerant censorship of books and writings, only two newspapers are printed in German at Vienna, one the Observer, the State Journal, and the Gazette, the Commercial and Official Advertizer. The police is a prying personal Inquisition.

The bribery of the press, in this country, is extensive, and very systematic. In papers of large circulation, a considerable portion is paid for, to serve particular interests. Articles in chief places, and identified with editor's matter, command very high prices; and an administration, seeking to puff its measures, pays as much as a guinea per line, and often 100*l.* for a single article.

The Journal des Sçavans was the original of works of periodical criticism. It was imitated in all countries; and the Monthly Review took the lead in England, and had its rivals; but the activity of literature, early in this century, demanded Weekly Reviews, and we now have the Athenæum, the Literary Gazette, &c.

The first, in England, was called the Wales of Literature, which commenced in 1714, and was discontinued in 1722.

The present state of the Republic of Letters began in 1719. Various periodical miscellanies were commenced in the reign of Anne, and continued for various periods. Cave took up an old title in the Gentleman's Magazine, in 1731; in 1732, the London Magazine was begun; and, in 1795-6, the Monthly Magazine, which was conducted for 30 years by the Editor of this Volume.

In certain parishes of Westminster, the coffee-houses, public-houses, and eating-houses, take in 264 Morning Advertiser, 228 Weekly Dispatch, 85 Bell's Life in London, 110 Morning Chronicle, 81 Times, 64 Morning Herald, 39 Globe, 13 Standard, 54 Sunday Times, 82 Sun, 28 Chambers, 21 Mirror, 16 Saturday Magazine, only 10 Penny Magazine, 29 Satirist, 29 Era, and 5 and 10 of other works.

In the United Kingdom there is one newspaper to every 47,000 inhabitants. In Russia but one to 670,000. In France one to 50,000, and in Belgium one to 40,000.

Previous to the printing of newspapers, London had its letter writers, who sent written news for a subscription of 3*l.* or 4*l.* per annum. L'Estrange, in 1663, commenced his meagre Intelligencer once a week; and, in 1665, the London Gazette twice a week. In 1701, London had 1 daily paper, 15 thrice a week, and 2 twice.

A delightful Miscellany has been published at Hobart's Town, Van Diemen's Land, by Mr. James Ross, equal in interest and good taste to any of the London Miscellanies. It adopts the title of Monthly Magazine, originated in London in 1 95.

Newspapers and periodicals are circulated in the United States, at 1 and 1½ centimes each; and pamphlets per sheet, at 4 and 6

centimes. In 1831, 237 papers were published in the State of New York, 16 of them daily. There were 54 in New York, which in the year produced 9,536,000 sheets.

The subscribers to the Paris journals, in June, 1837, were,—

La Presse	14,333
Le Siècle	12,100
Les Debats	8,333
Le Constitutionnel	7,005
The Courier, and Gazette de France, *each*	5,000
Le Temps	4,350
La Quotidienne	4,200
L'Estafette	4,000
La Tribunaux	3,866
Le National	3,333
Le Monachique, Journal de France, and Journal de Paris, *each*	2,500
Le Messager, & Moniteur, *each*	2,000

There are 10 or 12 others, down to 700 or 500.

There are but 4 newspapers, 3 weekly and 3 monthly miscellanies, at Hamburgh; and those under a censor, himself a tool of the Diet of Ratisbon.

Balbi, a very eminent statician, in 1832, attempted to enumerate the newspapers and journals of all nations. He reckoned 2141 in all Europe, 978 in America, 36 in Asia and islands, and 12 in Africa. He assigns 870 to the United States, but a late American Editor says there are nearly 1200 several newspapers: there being 65 in New York, 43 in Boston, and in the province of New York 263, besides 38 magazines and journals! Balbi assigns 490 to France, 483 to the British islands, to Austria 80, Prussia 288, Germany 305, Russia 84, Netherlands 150, Sweden 82, Denmark 80, Italy 63, &c. &c. Such works form a great feature of modern society, and must be productive of immense benefits. They emancipate mankind from the insulting thraldom of the schools, and the obsequious conformity of arrogant societies; but their benefits depend on their honesty, and the public spirit of their Editors.

The most memorable instance of celerity, in English topography, was that of Damberger's Travels through Africa, effected by the Editor of this volume. He received the German volume of the original on a Wednesday morning, at 11 o'clock. Before 12, 36 sheets were divided among 6 active and able translators. Before 1, the map for finish, and the 3 engravings, were in the hands of engravers. By 6, English MS. was at the Printer's, and, from that time, a regular supply was kept up to above 20 pair of cases of Pica type. On Thursday evening, 1500 of several sheets were worked at proofs, and proofs revised of the engravings, which on Friday morning were in the hands of colourers. On Friday, at 2, the 34th and last sheet was in chase; and, at 8, the whole was rapidly drying. On Friday morning was written a translator's critical preface of 12 pages. At 2 o'clock, on Saturday morning, the binders brought in perfect volumes. At ½ past 2, the Editor's clerks were subscribing the volume through the trade; and, on Saturday evening, at ½ past 6, not one copy remained on hand. The 1500 were all sold, and so well distributed, that, from that day to this, the Editor has never, even by chance, seen a single copy.

Number of Newspaper advertisements in 1830 and 1838, the duty being reduced, in 1833, from 3*s.* 6*d.* to 1*s.* 6*d.*

	1830	1838
England	777,445	1,315,580
Scotland	100,527	176,411
Ireland	119,885	178,200

In the first year of the penny stamp, newspapers rose from 35½ to 53½ millions.

One of the peculiar powers of printing has been that combination of editors and printers which produces daily and weekly newspapers. They are, in England, a fourth estate, with influences equal to the 3 others. Their collisions are some guard of the truth; but, as profit is their main object, and bribery an open system, so they require to be read with caution and mutual comparison. In other countries, except the American Republics, they are under control of the police, and less influential, because less free.

The perfection of Printing has, in fact, been effected by composition in stereotype, and the taking impressions by machines, often worked by steam. Stereotyping is a return to solid page or block-printing, but with this difference, that the mould is prepared on moveable types. The best use is thus made of them, and the mould for casting is prepared in the most economical manner.

The solid plates are not incompatible with corrections of letters or words, or even sentences; and we thereby have to work off only what are likely to be sold in reasonable time, so that the solid pages remain for correction when a new edition is wanted, and even whole new pages may be added or substituted.

A printing-machine disposes the pages on a table, under a cylinder, which, when carried round, are brought in contact with the inking-rollers, evenly inked, and then conveyed to the wet paper, and impressed either on one side or both. As a machine for varied purposes, it is very ingenious and economical, for it requires only two boys, one to lay down the paper, and another to remove the last impression. In this way 2000 sheets are printed on both sides in an hour, while the old hand-press, with two men, perfects but 250. It is such means that enables the Times newspaper to perfect nearly 12,000 impressions in publication-hours, and the machine-printers to turn out even work at half the price of the hand-press, though, for fine work, and short numbers, the hand-press is much to be preferred.

Stereotype-printing was introduced in London early in this century, by EARL STANHOPE, through a clever printing-agent, ANDREW WILSON, who brought to bear on the process about 40,000*l.* of the capital of MR. MOWBRAY and CAPTAIN PRICE, two East Indian fortunes, but who lost the whole before the method became popular.

Periodical Magazines, Reviews, &c. weekly, monthly, and quarterly, in the United Kingdom.

WEEKLY AND MONTHLY.

	s.	d.
Aldine Magazine	1	0
Annals of Natural History ..	2	6
Anthropological Magazine	0	6
Army List	1	6
Asiatic Journal	3	6
Athenæum	0	4
Beau Monde	2	0
Bell's Gentleman's Fashions ..	1	0
—— Reptiles	2	6
Bentley's Miscellany	2	6
Blackwood's Edinburgh Magazine	2	6
———— Lady's Magazine ..	2	0
Botanical Magazine	3	6
——— Register	3	6
Botanic Garden (Maund's)	1	0
Botanist	1	6
British Magazine	2	6
Brown's Natural History	1	0
Chambers's Journal	0	1½
Court and Lady's Magazine ..	2	6
Domestic Economy	0	6
Dublin Medical Journal	3	6
——— University Magazine ..	2	6
East-India Magazine	2	6
Ecclesiastical and Legal Guide ..	1	0
Eclectic Review	2	6
Edinburgh Cabinet Library ..	5	0
Educational Magazine	0	6
Engineers' and Architects' Journal	1	0
Farmers' Magazine	1	6
Floricultural Cabinet	0	6
———— Magazine	0	6
Fraser's Magazine	2	6
Gentleman's Magazine	2	6
Guy's Hospital Reports	6	0
Hood's Own	1	0
Horticultural Journal	1	6
Inquirer	0	6
Jones's Outlines of Natural History	2	6
Journal of the Statistical Society ..	1	6
Lady's Pocket Magazine	0	6
Ladies' Cabinet	0	6
Literary Gazette	0	6
——— World	0	2
London Journal of Science	2	6
——— and Paris	1	0
——— Miscellany	1	6
Loudon's Gardener's Magazine ..	1	6
——— Ladies' Flower Garden ..	2	6
——— Naturalist	2	0
M'Intosh's Fruit Garden	1	0
———— Practical Gardener ..	2	0
Mechanic's Magazine	0	2
Medical Portrait Gallery	3	0
Memorials of Cambridge	1	0
Metropolitan Magazine	3	6
Mirror	0	2
Monthly and European Magazine	2	6
——— Review	3	6
——— Belle Assemblée	1	0
——— Law Magazine	3	6
——— Chronicle	2	6
Naturalist	2	0
Nautical Magazine	1	0
New Monthly Magazine	3	6
—— Sporting Magazine	2	6

	s.	d.
Parbury's Oriental Herald	2	6
Paxton's Botany	2	6
Penny Cyclopædia .. Part ..	1	6
——— Magazine .. 1*d*. or ..	0	6
Phil. Mag. and Ann. of Philos. ..	2	6
Pilot	0	3
Pinnock's Guide to Knowledge ..	0	2
Railway Magazine	1	6
———— Times	1	0
Raphael's Occult Philosophy ..	1	0
Repertory of Arts	3	6
Saturday Magazine .. 1*d*. or ..	0	6
Sowerby's Supplem. to English Botany	3	0
———— English Botany	1	0
Sporting Magazine	2	6
———— Review	2	6
Sportsman	1	6
Standard Novels	6	0
Sunbeam	1	0
Tait's Edinburgh Magazine ..	1	0
Townsend's Parisian Fashions ..	1	6
———— Coiffures	0	6
United Service	3	6
Vegetable Organography	2	6
Veterinarian	2	0
Westwood's Classification of Insects	2	6
World of Fashion	2	0
Youth's Instructor	0	4
——— Magazine	0	4
Young Man's Magazine	0	2
——— Ladies' Magazine	0	6

QUARTERLY.

	s.	d.
Advocate of Humanity	1	6
Annalyst	4	0
British and Foreign Medical Review	6	0
———— Review ..	6	0
British Critic and Theological Review	6	0
——— Farmer's Magazine ..	3	0
Carthusian (The)	2	6
Christian Teacher	2	6
Church of England Quarterly ..	6	0
Dublin Review	6	0
Edinburgh Medical Journal ..	6	0
———— Philos. Journ. (Jameson's)	7	6
———— Review	6	0
Foreign Quarterly	6	0
Freemason's Quarterly	3	0
Intellectual Repository	1	0
Isis (The)	5	0
Law Magazine	6	0
London and Westminster Review	6	0
Medico-Chirurgical Journal ..	6	0
Navy List	2	0
Phrenological Journal	2	6
Quarterly Journal of Agriculture	5	0
——— Review	6	0
Sturgeon's Annals	2	6
Taylor's Scientific Memoirs ..	6	0

Many more are published, consisting chiefly of fanatical trash, addressed by illiterate editors to the lowest degrees of intelligence. There are also 10 or 12 Penny Works, but of declining circulation.

Official Returns of Newspaper Stamps used by the Papers of the United Kingdom, with a determination of their average Sale, per publication, in October, November, and December 1838.

80 LONDON PAPERS. *Sale per Publication of each Paper, from Oct. 1, to Dec. 31, 1838.*	*Sale.*	Stamps, October.	Stamps, November.	Stamps, December.
Age	2,539	9,000	12,000	12,000
Atlas	3,308	10,000	13,[illegible]00	19,500
Athenæum	1,393	4 500	6,500	4,500
Bent's Literary Advertiser	251	1,000	1,000	1,250
Bell's Life in London	20,3[illegible]5	130,000	100 000	35,000
Bell's New Weekly Messenger	2,847	13,000	11,000	13,000
Bell's Weekly Messenger (2 editions)	8,700	84,000	70 000	72,000
British Emancipator	924	4 000	4,000	4,000
Courier	1,256	35 000	29,000	31,000
County Chronicle	1,651	7,000	8,500	6,000
County Herald	847	3,000	4,000	4,000
Champion	809	3,500	4 000	3,000
Court Journal	1,848	7,000	7,000	10,000
Christian Advocate	882	3,425	4,600	3,377
Circular to Bankers	385	2,000	2,000	1,000
Commercial Daily List	172			700
Court Gazette	2,195	8,000	6,000	14,500
Commercial Gazette	693	2,000	4,000	3,000
Crown	1,232	5 000	6,750	4,850
Cinque Ports Chronicle	539	2,500	2 500	2,000
Colonial Gazette	963		5,500	7,000
Christian Spectator	1,154			15,000
Englishman	231	1,000	1,000	1,000
Evening Chronicle (3 per week)	1 500	22,000	20,000	16,000
Examiner	5,137	20,050	25,900	21,100
English Chronicle (3 per week)	834	12,000	6,000	15,000
Evening Mail ditto	1,800	45,000	25,000	23,500
Ecclesiastical Gazette	3,520	11,250	23,000	11,500
Era	8,231	30 000	30,000	47,000
Globe	2 770	90,000	54,000	72,000
Gardener's Gazette	3,000	15,000	12 000	12,000
John Bull	4,308	21,000	17,000	18,000
Jurist	2,154	10 000	8,000	10,000
Justice of Peace Recorder	1,504	7,500	6,000	6,000
London Mercantile Journal	462	1,500	3,000	1,500
London Dispatch	4,282	25,600	15,000	15,000
Literary Gazette	578	2,500	2,000	3,012
Law Chronicle	80	540		540
London Gazette (2 per week)	1,540	20,000	20,000	13,400
London Price Current	39			
Morning Chronicle	6,300	169,000	154,000	168,000
Morning Post	2,560	69,000	68,000	62,500
Morning Herald	5,833	160,000	130,000	165,000
Mining Journal	1,271	5,500	5 500	5,500
Metropolitan Conservative	2 886	9,000	10,500	18,000
Morning Advertiser	5,000	120,000	150,000	120,000
Mark Lane Express	4,000	15,000	16,000	21,000
Magnet	4,462	20 500	16 500	21,000
Naval and Military Gazette	1,470	7,150	6,000	6,000
News and Sunday Globe	1,848	10 000	7 500	6,500
Observer	7 693	50,000	50,000	33,500
Operative	1,812		13,400	10,000
Perry's Bankrupt Gazette	390	1,149	1,915	2,006
Patriot	3,195	25,000	15,000	11,500
Public Ledger	380	10 000	9 000	10,000
Publisher's Circular	1,660	7,100	7,500	7,000
Planet	4,733	19 000	15 500	27,000
Police Recorder	1,380	6,000	4,500	7,200
Pawnbroker's Gazette	221		450	2,400
Racing Calendar	385	2,250	1,375	1,375
Record (2 per week)	2,077	27,500	23,000	23,500

LONDON PAPERS—*continued.*	*Sale.*	Stamps, October.	Stamps, November.	Stamps, December.
Railway Times	1,848	8,000	8,000	8,000
Sunday Times	13,460	60,000	50,000	65,000
Standard	3,270	75,000	80,000	100,000
St. James's Chronicle (3 per week)	4,666	65,000	52,000	65,000
Shipping Gazette	624	30,000	24,000	27,000
Sun	3,462	96,000	90,000	90,000
Spectator	2,772	15,000	9,000	12,000
Satirist	2,772	10,500	13,500	12,000
Social Gazette	770	—	—	10,000
South Australian Record	481	2,000	2,250	2,000
Sunbeam	96	550	300	375
Spirit of the Times	97	302	302	414
Stranger's Guide	117	—	—	500
Times	11,600	280,000	350,000	290,000
United Service Gazette	1,386	6,500	5,500	6,000
Universal Corn Reporter	115	—	700	485
Weekly Chronicle	35,000	128,000	117,000	210,000
Weekly Dispatch	49,230	200,000	200,000	240,000
Weekly True Sun	4,500	22,500	21,000	15,000
Watchman	3,117	9,000	14,500	17,150

N. B. Several of the London publications sell a larger impression of Unstamped than Stamped copies.

217 ENGLISH PROVINCIAL PAPERS,

With the average Weekly Sale of each.

Aylesbury News	1,200
Bristol Mirror	2,620
Bury and Norwich Post	1,625
Bath Herald	1,077
Bath Chronicle	1,347
Brighton Gazette	1,154
Brighton Guardian	1,385
Bucks Gazette	154
Bury Herald	617
Brighton Patriot	760
Birmingham Journal	2,500
Brighton Herald	1,231
Bath Journal	1,000
Birmingham Gazette	2,305
Bucks Herald	461
Bath and Devizes Guardian	700
Bristol Gazette	961
Bath and Cheltenham Gazette	1,231
Boston Herald	231
Bradford Observer	625
Berkshire Chronicle	539
Bedford Mercury	923
Birmingham Advertiser	1,154
Blackburn Gazette	231
Blackburn Standard	462
Bolton Free Press	462
Bolton Chronicle	1,000
Bristol Mercury	2,305
Britannia	290
Berwick Advertiser	500
Berwick Warder	385
Bath Post	693
Bengal Hurkaru Extra	231
Chester Courant	924
Cambridge Chronicle	1,368
Chelmsford Chronicle	1,770
Coventry Standard	770
Cornwall Royal Gazette	616
Cheltenham Chronicle	923
Coventry Herald	1,077
Cheltenham Journal	770
Cumberland Pacquet	385
Cheltenham Looker on	770
Cheltenham Free Press	923
Chester Gazette	1,000
Carlisle Journal	2,000
Chester Chronicle	1,848
Cheshire Reformer	924
Carlisle Patriot	924
Chard Union Gazette	117
Cambridge Advertiser	250
Durham Chronicle	1,077
Devonport Telegraph	770
Devonshire Chronicle	265
Dorset County Chronicle	1,617
Devonport Independent	1,000
Derby Mercury	1,346
Dover Telegraph	500
Derbyshire Courier	462
Doncaster Gazette	1,848
Devizes and Wiltshire Gazette	1,154
Dover Chronicle	308
Derby Reporter	1,004
Doncaster Chronicle	693
Durham Advertiser	730
Exeter Flying Post	1,923
Exeter and Plymouth Gazette	2,310
Essex Standard	1,288
Essex, Herts, and Kent Mercury	1,540
Essex and Suffolk Times	693
Eastern Counties Herald	1,848
Falmouth Packet	616
Felix Farley's Bristol Journal	1,848
Falmouth Express	578
Gloucester Journal	1,740
Greenwich Gazette	847
Gloucestershire Chronicle	1,540
Gateshead Observer	2,310
Hereford Journal	1,400
Hampshire Chronicle	1,426
Hampshire Telegraph	2,308
Herts Reformer	461
Huntingdon Gazette	1,961

Hampshire Advertiser	3,234
Halifax Express	117
Hull Advertiser	1,232
Hampshire Independent	1,348
Hull Packet	385
Hull Rockingham	770
Hertford County Press	462
Halifax Guardian	425
Harrowgate Advertiser	177
Hereford County Press	1,232
Hull Times	981
Ipswich Journal	1,961
Kentish Gazette	924
Kent Herald	1,271
Kentish Chronicle	39
Kentish Observer	924
Kendal Mercury	770
Kidderminster Messenger	847
Kent and Surrey Patriot	453
Leeds Intelligencer	3,462
Lincoln Gazette	1,309
Leicester Journal	1,848
Liverpool Courier	1,490
Leicestershire Mercury	1,463
Leamington Spa Courier	924
Leicester Herald	231
Leamington Chronicle	231
Leicester Chronicle	1,232
Lancaster Gazette	693
Lincolnshire Chronicle	1,540
Lincoln Standard	308
Leeds Mercury	9,240
Leeds Times	1,848
Liverpool Mail	2,500
Liverpool Standard	2,000
Liverpool Mercury	6,460
Liverpool Times	924
Liverpool Chronicle	1,843
Liverpool Journal	924
Liverpool Albion	3,427
Lancaster Guardian	850
Leicestershire Telegraph	250
Liverpool Advertiser	1,309
Lancashire Herald	924
Monmouthshire Merlin	2,117
Maidstone Journal	1,232
Maidstone Gazette	1,386
Myer's Mercantile Advertiser	1,077
Macclesfield Courier	1,077
Manchester Guardian	11,150
Manchester Times	2,654
Manchester Courier	2,577
Manchester Chronicle	1,690
Manchester and Salford	4,000
Monmouthshire Beacon	1,000
Midland Counties Herald	5,385
Manchester Journal	2,077
Norfolk Chronicle	2,619
Northampton Mercury	1,848
Nottingham and Newark	1,816
North Devon Journal	500
Newcastle Journal	3,462
Northampton Herald	2,300
Norwich Mercury	1,843
Nottingham Review	2,000
North Devon Advertiser	308
North Derby Chronicle	924
Nottingham Journal	1,386
North British Advertiser	8,600
Northern Star	10,048
Newcastle Courant	4,130
Newcastle Chronicle	3,190
Northern Liberator	1,154
Oxford Journal	1,926
Oxford Chronicle	1,386
Oxford Herald	924
Plymouth Herald	774
Plymouth and Devonport	578
Preston Pilot	539
Preston Chronicle	1,154
Preston Observer	308
Reading Mercury	2,890
Sherbourne Journal	1,400
Stamford Mercury	7,589
Star in the East	1,100
Somerset County Gazette	575
Sussex Advertiser	1,077
Sheffield Independent	1,585
Staffordshire Advertiser	3,462
Shrewsbury Chronicle	1,617
Staffordshire Examiner	924
Sheffield Iris	924
Sheffield Mercury	1,733
Suffolk Chronicle	2,308
Sherbourne Mercury	655
Salisbury and Wiltshire	924
Surrey Standard	462
Sunderland Herald	578
Sussex Express	1,617
Salisbury Journal	3,080
Sheffield Chronicle	450
Staffordshire Mercury	1,502
Salopian Journal	1,600
Scarborough Herald	142
Stockport Advertiser	578
Sunderland Beacon	462
Shrewsbury Reporter	1,348
Sheffield Patriot	1,500
Staffordshire Gazette	1,250
Taunton Courier	616
Tyne Mercury	231
Western Times	1,848
Wolverhampton Chronicle	1,072
Worcestershire Guardian	1,077
Warwick Advertiser	1,154
West Kent Guardian	154
Western Luminary	616
Whitehaven Herald	578
West Riding Herald	693
West Briton and Cornwall Advertiser	2,000
Windsor and Eton Express	924
Wiltshire Independent	1,000
Worcester Herald	2,200
Wilts and Gloucestershire Standard	485
Worcester Journal	2,193
West of England Conservative	924
Wigan Gazette	77
Westmoreland Gazette	924
Worcestershire Chronicle	462
Yorkshire Gazette	2,539
York Chronicle	539
York Courant	2,000
York Herald	3,534
Yorkshireman	1,980

62 SCOTCH PAPERS.

Aberdeen Herald	2,480
Aberdeen Journal	2,849
Aberdeen Constitutional	1,232
Ayr Advertiser	1,309
Ayr Observer	705
Ayr Examiner	693

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Arbroath Journal	318
Arbroath Herald	370
Dumfries Times	1,232
Dumfries Courier	2,308
Dumfries Herald	964
Dumfries Galloway	693
Dundee Advertiser	462
Dundee Chronicle	462
Dundee Courier	370
Edinburgh Courant	5,077
Edinburgh Mercury	1,810
Edinburgh Advertiser	2,772
Edinburgh Gazette	137
Edinburgh Journal	1,579
Edinburgh Chronicle	924
Edinburgh Observer	770
Edinburgh Saturday	1,015
Elgin Courant	616
Fife Herald	1,000
Fife Journal	616
Forres Gazette	154
Glasgow Courier	3,080
Glasgow Journal	270
Glasgow Chronicle	1,436
Glasgow Herald	5,544
Glasgow Saturday	1,271
Glasgow Argus	2,117
Glasgow Constitutional	462
Greenock Advertiser	1,154
Gray's Weekly Record	5,050
Inverness Courier	1,386
Inverness Herald	770
John O'Groat's Journal	924
Kelso Mail	1,000
Kelso Chronicle	616
Kilmarnock Journal	539
Montrose Review	1,386
Montrose Standard	308
Northern Star	195
Paisley Advertiser	462
Perthshire Courier	231
Perthshire Advertiser	1,039
Perthshire Constitutional	1,154
Perthshire Chronicle	308
Scotsman	5,390
Scottish Jurist	38
Scottish Pilot	1,117
Scots Times	924
Scottish Guardian	2,464
Scotch Reformers' Gazette	2,154
Stirling Journal	847
Stirling Observer	686
Scottish Advertiser	964
True Scotsman	2,539

10 WELSH PAPERS.

Carmarthen Journal	1,154
Cambrian	1,926
Carnarvon and Denbigh	867
Cronicl yr Oes	535
Merthyr Guardian	1,309
North Wales Chronicle	462
Silurian	500
Welshman	770
Y Brytwn	154
Cornubian	39

16 DUBLIN NEWSPAPERS.

Saunders's News Letter	1,900
Morning Register	500
Freeman's Journal	577
Morning Herald	330
Evening Mail	1,615
Evening Post	1,600
Evening Packet	849
Evening Pilot	416
Dublin Statesman and Record	420
Weekly Register	2,460
Weekly Freeman	2,618
Weekly Warder	1,849
General Advertiser	6,346
Temperance Gazette	924
Mercantile Advertiser	385
Protestant Guardian	1,154

54 IRISH COUNTRY NEWSPAPERS.

Belfast Commercial Chronicle	2,154
Belfast News Letter	2,154
Belfast Christian Patriot	1,000
Belfast Reformer	231
Northern Whig	2,310
Ulster Times	3,234
Westmeath Guardian	174
Cork Constitution	2,772
Cork Standard	1,154
Southern Reporter	3,8 0
Ballyshannon Herald	270
Newry Telegraph	2,310
Newry Examiner	924
Downpatrick Recorder	770
Drogheda Journal	693
Drogheda Conservative	335
Drogheda Argus	388
Fermanagh Impartial Reporter	383
Enniskillen Chronicle	308
Galway Weekly Advertiser	231
Galway Patriot	195
Tuam Herald	385
Kerry Evening Post	385
Tralee Mercury	770
Leinster Express	775
Leinster Independent	385
Kilkenny Journal	306
Kilkenny Moderator	385
Carlow Sentinel	193
Limerick Chronicle	5,390
Limerick Star and Evening Post	1,309
Limerick Standard	462
Clare Journal	462
Londonderry Journal	1,077
Londonderry Sentinel	195
Londonderry Standard	195
Roscommon Gazette	117
Roscommon Journal	620
Mayo Constitution	620
Mayo Telegraph	578
Nenagh Guardian	578
Achill Missionary Herald	385
Northern Standard	385
Sligo Journal	450
Sligo Champion	462
Tipperary Free Press	616
Tipperary Constitution	616
Waterford Weekly Chronicle	480
Waterford Mirror	770
Waterford Mail	192
Waterford News Letter	192
Wexford Independent	770
Wexford Conservative	385

The largest daily Sales are those of the Times, 11,800 per day. The Morning Chro-

nicle is 6 300. The Morning Herald, 5,853; and the Morning Advertiser, 5,000.

The greatest Sales of the daily Evening Papers are the Sun, 3 462; the Standard, 3,270; and the Globe, 2,770.

Of the 3 times a week papers, the St. James's Chronicle is 4,666; and the Evening Mail, 1,800.

Of the Sunday Papers, the Dispatch exhibits the astonishing number of 49 230; and the Weekly Chronicle, 35,000. The Sunday Times follows at 13,460.

Among the Provincial Papers, a Manchester Paper transcends all others in a weekly sale of 11,150. The Leeds Mercury rises to 9,240; the Stamford Mercury 7,580; and the Liverpool Mercury to 6 400 The North British Advertiser is 8,600, and the Northern Star 10,018

Of the Scotch Papers, 4 rise above 5,000.

Only the Dublin General Advertiser, (if weekly) rises to 6 346; the Limerick Chronicle is 5,390; and the Southern Reporter is 3,850.

On the 5th of November, 1831, a Turkish newspaper, called *Taakvini Veekai*, or the "Tablet of Events," first appeared in the Turkish capital. In order to give it more extensive circulation, every Pasha in the empire is obliged to subscribe for a certain number of copies, for the information of the people of his Pashalik.

An Armenian newspaper is published at a monastery near Venice, and much read through the Levant.

In 1830, there were 31 periodicals in Bengal; 8 in the native tongue. At Madras, 5 English; and at Bombay, 4.

THE DRAMA.

The dramatic Arts, like other favourite social pursuits, have been modern creations. Our immediate ancestors had no recreation but the vulgar, savage pursuits of the field, followed by gross nightly drunkenness: while the women were the habitual dupes of every form of priestcraft. The ancients had no drama in our sense, but spouting, chorus, and, lastly, set dialogues of two, constituted their dull drama. The Catholic priests then forced their blasphemous mysteries on the people. The results, in the age of Elizabeth, were the invention of scenes and dialogues in character; in fine, our Tragedy, Comedy, and Farce. These, again, promoted orchestral bands, and led to all the forms of musical composition, singing, &c. &c.

The absurd exclusiveness of a frivolous aristocracy has, however, tended to promote performances in foreign languages; royal licences, too, have checked competition, while late dinner-hours, as in despite of social order, have injured our national theatre in town and country. We, nevertheless, have 15 or 16 London theatres, open 200 nights in the year, with varied success; and there are 30 or 40 provincial theatres, moderately well supported.

In France, every thing yields to the theatre; and the Parisian population, as one family, regularly fill its 30 theatres every night in the year. Neither drunkenness nor vulgar sports interfere with the general passion for every form of the Drama.

Christian Mysteries, or Sacred Dramas, were contrived 1000 years ago by the clergy, to supersede the pageantry of Pagan Festivals. The Chester Mysteries, or Whitsun plays, were in 1268. The Moralities succeeded, and then Historical Dramas.

The first comedy, La Calandra, was performed in Italy, in 1490, and Sophonisba, in 1515. Lopez de Vega, and Calderon, followed in Spain. Corneille flourished in France, from 1610 to 1684; and Shakspeare, in England, from 1590 to 1612

The first patent for a theatre was to Killigrew for Drury lane. the next to Davenant for Lincoln's-Inn-Fields, called the Duke's since Covent-garden.

In 1551, Bishop Still wrote the first English dialogue drama, called the Search after Gammer Gurton's Needle, when needles were more costly than at present.

The first tragedy, in English, was Gorbaduc, or Ferrex and Perrex, in 1561; and the first comedy, the Supposes, in 1566.

In 1581 Marlowe began to write; and, in 1589, Shakspeare who wrote 36 plays, containing 103,972 lines. The longest, Hamlet, 4058 lines, and the shortest, the Comedy of Errors, 1807.

His first play was Pericles, acted in 1590; he then wrote one or two per annum till the Twelfth Night, in 1613. Some of the descendants of his sister Joan still reside at and near Stratford, in indigence. The Editor and the late Mr. Charles Mathews attempted public subscriptions but they failed, though millions have been realized by his works, in theatres and various editions.

By a late Act, authors are entitled to a gratuity on every performance of their pieces.

Since Shakspeare's age there have been Dryden, Wycherley, Otway, Farquhar, Centlivre, Rowe, Congreve, Addison, Steele, Vanbrugh, Cibber, Young, Murphy, Foote, Cumberland, Holcroft, O'Keefe, Inchbald, Cowley, Morton, Colman, Sheridan, Kenny, Knowles, &c.

In 1589, there were The Globe, the Curtain, The Theatre, The Red Bull, The Fortune, The Blackfriars, The Phœnix, The Whitefriars, The Swan, The Rose, and The Hope; in all, 11; and a proof of public attention and favour.

James I. licensed Shakspeare's company at the Globe, &c. in 1603.

In 1613, the Globe was burnt; but, in 1614, rebuilt, on part of the site of Barclay's Brewery.

In 1647, the puritan priests suppressed the theatres and persecuted the players.

In 1659, the Restoration party re-opened the theatres, when Betterton and Kynaston first appeared.

Drury-lane, the Duke's, and other theatres opened. In 1672, Drury lane was burnt.

The 18th century opened with Mrs. Barry, Oldfield, Bracegirdle, Booth, and Wilkes, on

the stage; and, as authors, Centlivre, Farquhar, Rowe, Addison, Steele, Congreve, Vanbrugh.

Cato was performed in 1711, and the Beggar's Opera in 1727. Quin, Fenton, Clive, Cibber, Pritchard, Woffington, Macklin, Garrick, Foote, Barry, and King, all appeared before 1750.

In 1705, the Haymarket was built; and, in 1733, Covent-garden.

In the next half century appeared Mrs. Yates, Abingdon, Catley, Siddons, Farren, Jordan, O'Neil, &c.; and Messrs. Braham, Munden, Henderson, Kemble, Betty, Cooke, Kean, Macready, &c.

Garrick retired June 10, 1776, and his Stratford Jubilee was in 1769.

The Opera-house was burnt in 1789; Covent-garden, Sept. 1808; and Drury-lane, Feb. 1809.

These theatres have since been re-built, in a style and solidity of architecture which renders them ornaments of the metropolis, with capacity for holding as many spectators as yield from 600*l.* to 1000*l.* a night. Their properties, scenery, machinery, &c. &c. are on an astonishing scale, and imply the absorption of great capital. They are courted by the first talent, and pay munificent salaries. They have become, in fact, a great social engine, both for instruction, rational amusement, and the reform of manners. Their abuses are no features of their system.

The great London theatres of Drury-lane and Covent-garden, with the Italian Opera, are surpassed, in general conduct and public respect, by none in Europe. The Haymarket, the English Opera, and the St. James's Theatre, are also very creditable establishments. The Vestris, or Olympic Theatre, the Adelphi, the Victoria, the Surrey, the Equestrian, Sadler's Wells, the Tottenham Court, &c. &c. are also well supported by the public, and possess powerful attractions.

The competition, vast expences, and increase of salaries to favourite performers, have not, however, rendered the great theatres profitable speculations for some years. Even in France support from the state is necessary, but the proposition could not be entertained in England while they continue the open market for courtezans.

In the provinces of England there are well built theatres in all great towns, but the indiscriminate admission of women causes them to be considered as schools of vice rather than of morals and manners, which, under other conduct, they would be. In consequence, they are often thwarted by the narrow spirit of Methodist and sectarian prejudices, and the people are left with no amusements but what are afforded by taverns and public-houses.

The boxes of Drury lane Theatre hold 1200 auditors; the pit, 860; the first gallery, 480; and the second, 280; making, with performers, &c. 3000 in a full theatre. The Italian Opera-house, London, will hold 1500*l.*

Drury-lane and Covent-garden Theatres, previously to 1790, held 400*l.* Since then they have been enlarged, so as to hold from 550*l.* to 600*l.* A third of the box-audience consists of free admission or orders. Pantomime and show-pieces, in the time of Garrick and Rich, cost from 2 to 3000*l.* and latterly, they have cost more, but pay best.

London patentees charge 160*l.* a night as the current cost of the expences. A century ago it was 80*l.*

Distinctions of rank in the auditory prevailed in the seats of the Greek and Roman theatres nearly as in our provincial towns.

In the Opera Season, 1832, the expences of the Lessee were,—

Italian and French Performers	£17,660
German	6,358
Ballet	8,270
Orchestra	6,448
Rent	16,050
Printing, lighting, &c.	11,470
Total	£66,256
Receipts:—	
Italian Opera	38 581
French	3.521
German	10 556
Concerts, &c.	2.778
Total	£55,440

Loss on the season, 10,716*l.* Such, in fact, since the panic of 1825, has been the annual condition of nearly all the showy establishments of London; and, in fact, of almost every establishment in the whole Empire.

There are 15 regular theatres open all the year in Paris, besides 10 or 12 occasional, the prices to the audience in which vary from 10 francs to 2. In aid of them, the government grants 60,000*l.* per annum, and about 10,000 visit them every evening in the year. Authors of pieces get 1-18th of the gross receipts, and for 1 act a 36th, wherever it is performed, till ten years after death. 1-10th of all the receipts at theatres and exhibitions is given to the poor.

The Theatre Français is 166 ft. long, 105 broad, 100 high, and holds about 1520 persons. The Odeon 168, 112, and 104, and holds 1800. The stage of the French Opera is 42 ft. wide, and 82 deep, and it holds 1937 spectators, and is always full. The Italian Opera holds 1282. The Comic Opera, 1728. Four others hold 1800.

Paris has 5 public gardens like Vauxhall, and in summer a fine concert every evening in the Champ Elysées. The French carry fêtes and all amusements to the highest possible perfection, and all ranks concur, and without mingling. Every Sunday evening there are public dances, in which all classes join, for a small fee to the musicians. The moral effect is excellent, and drunkenness, picking of pockets, &c. are unknown in France.

The 19 Theatres in London are as under, in 1840:—

Her Majesty's Theatre, Haymarket, for Italian Opera and Ballets.

Theatre Royal Drury-lane, for regular Drama, Operas, Spectacle, and Oratorios.

Theatre Royal Covent-garden, ditto.

Theatre Royal Haymarket, for regular Drama and Operas.

New Theatre Royal Lyceum and English Opera-house, Strand, for Operas and Spectacle.

Royal Adelphi Theatre, Strand, for Burlettas, Farces, and Spectacle.

Royal Olympic Theatre, Wych-street, for Vaudevilles and Operettas.

St. James's Theatre, King-street, St. James's, for Operas, Farces, &c.

Astley's Amphitheatre, Westminster-road, for Horsemanship and Spectacle.

Surrey Theatre, Blackfriars'-road, for Plays and Melo-Drama.

Royal Victoria Theatre, Waterloo-road, for regular and Melo-Drama and Spectacle.

City of London Theatre, Norton-Folgate, for regular and Melo-Drama.

Pavilion Theatre, Whitechapel-rd. ditto.

Garrick Theatre, Leman-street, Goodman's Fields, ditto.

Sadler's Wells Theatre, near the New River Head, for Melo-Drama, Pantomime, and Spectacle.

Queen's Theatre, Tottenham-street, for regular and Melo-Drama.

Strand Theatre, Strand, for Farces, &c.

Clarence Theatre, King's-Cross; Burlettas, Vaudevilles, &c.

Vauxhall-gardens, for Vaudevilles, Singing, Fire-works, &c.

Italy is celebrated for its theatres, and one at Naples, one at Milan, and one at Parma, are the largest in Europe. Madrid and Lisbon counteract ecclesiastical bigotry by their theatres. Germany has noble theatres every where, fine actors, and the best authors. Prussia, Denmark, Sweden, and Russia, especially the latter, are conspicuous in dramatic patronage. Brussels, and even Holland, support good theatres.

China has enjoyed dramatic performances for some thousand years, but very grave and sentimental.

North America, in concert with its liberal institutions, and in defiance of religious fanaticism, is munificent in dramatic patronage. Every large town has its sufficient theatre, always well attended. Nor are the South American States without ample theatres. In fine, theatres march with civilization through the world.

50l. was the price of the copyright of an acted play in Anne's reign. Sir R. Phillips gave 300*l.* for many, but 100*l.* was the price in 1838.

Dramatic Chronology.

1378 Mysteries in St. Paul's School.
1390 Interludes by parish-clerks.
1533 Hooker and Edwards wrote Comedies, and Buckhurst and Norton a Tragedy.
1564 Shakspeare born,—died 1616.
1570 to 1629 Seventeen theatres built.
1615 Beaumont died, aged 30.
1625 Fletcher died, aged 50.
1659 The cock-pit in Drury-lane,—a theatre.
—— Mrs. Behn died.
1666 Shirley and wife died of terror of the great Fire.
1671 Davenant died, aged 64.
—— Dorset Gardens opened.
1672 Drury-lane burnt down.
1701 Dryden died, aged 69.
1710 Betterton died.
1723 Mrs. Centlivre, aged 56.
1729 Theatre in Goodman's Fields.
—— Congreve died, aged 56.
1733 Covent-garden, by Rich.
1736 Barton Booth died.
—— The Haymarket opened by Fielding
1741 Garrick in Goodman's Fields.
1757 Colley Cibber died, aged 86.
1767 Foote re-built the Haymarket.
1777 Colman bought the same.
1779 Garrick and Arne died.
1812 Mrs. Siddons retired.
1816 Richard Brinsley Sheridan died.
1817 John Kemble retired.

In England, the audience direct every thing before the curtain, and the managers all behind it. In France, and other European countries, the spectators are subject to the strict regime of the Police. In England, the popular voice was displayed from September to December, 1809, owing to an attempt to raise prices on the opening of the new Covent Garden, and encroach on the public boxes. For two months the performances were rendered *dumb shew* by the incessant clangour of 200 watchmen's rattles, 100 dustmen's bells, 2 or 300 horns, 150 penny and speaking-trumpets, 200 cat-calls, several gongs, &c. a terrific concert, which began with the rise, and ended with the fall of the drop-scene of each act. Between the acts were pitch battles of parties, and speeches of excitement from the boxes. At length the leaders and managers came to a treaty, and on the 10th of December the popular claims were established, the O. P. were retained, and the private boxes reduced.

EDUCATION.

Education is the breaking-in of the young to the purposes and duties of society; and it is also the transference to the mind, by reiterated impressive exercises, of the actual state of knowledge and truth on all subjects.

Empirics write crudely about moral education, forgetting that morality is a *habit* resulting from *example* more than precept. The young human animal is best broke in by school attendance, and 6 or 8 hours of intellectual labour per day. The rest depends on parents, and on good examples. Public bounties to exemplary apprentices, to head boys in schools, and to heads of families, after virtuous lives, would be the most powerful of all incentives to moral conduct.

Superior Education is under the direction of Universities, and these are commonly directed by statutes of remote ages, and by precedents of ancient councils; so that, in most Universities, obsolete and useless stu-

dies far exceed the living and desirable. Other education is either preparatory to University studies, or it applies to the popular arts of reading, writing, and arithmetic, on terms inversely as numbers taught.

In many Foreign Universities, there are inspectors to reform and modernize studies; but, in general, Universities are pompous close corporations, devoted to some ancient inherited systems, in caricature of living knowledge, and never to be quoted in the world, after the attainment of the social passport of a degree.

A code for vivifying Universities is still a desideratum. Bishop Watson's case was, of course, not *the last* of its kind! A patron procured him the high-sounding appointment of *Regius Professor of Chemistry in the University of Cambridge*, when, as he himself declares, he had never read a book on Chemistry, heard a lecture, performed an experiment, or even seen one performed!

Until the Universities of Europe are utterly changed by kings or legislatures, the whole labour of education will continue to be wasted. They require some Luther to destroy their monkish and obsolete pursuits, and substitute living and useful ones. Till then, they will continue to stultify the aristocracy, whom they educate, and produce a race of students utterly useless in the world, in which they are intended to play a part.

Universities are a federal union of Colleges, in each of which there are lecturers, and public and private tutors, to qualify students, after a certain number of terms, to undergo an examination and admission to degrees of Bachelor, Master, Doctor, &c.

They commenced, without any idea of their ulterior purposes, in the 12th century. The first was at Bologna, in 1168; the second at Paris, in 1200; and those at Naples, Padua, Toulouse, Cambridge, and Oxford, were formed in the next half-century. Their objects and privileges were enlarged by degrees, and they have, for 2 or 3 centuries, formed a social feature in all civilized countries. Popes, Bishops, Sovereigns, Princes, and wealthy men, have vied in founding their Colleges, in endowing professors, and providing for students.

The United Kingdom has 10; France, 26; Austria, 6; Prussia, 6; Bavaria, 3; other German states, 9; Holland, 3; Belgium, 3; Russia, 7; Poland, 2; Sweden, 3; Denmark, 2; Spain, 11; Portugal, 1; Switzerland, 5; Italy, 19; and Corfu, 1;—in all, 117. In the United States are 10 or 12 colleges, and there are 3 or 4 in South America. In Europe, too, there are some colleges of the nature of universities.

The Mahomedan University of Cordova, in the 9th century, introduced the sciences into Europe, and was imitated in Christian countries, as it happened that a wise prince reigned; but, as these are very scarce, so Europe made little advancement for many centuries; and, even to this day, all the institutions favour authority rather than originality, and sustain prejudices instead of knowledge. In 1000 years, Alfred has been in England the only sovereign who resembled Al Mamun. His successors were priest-ridden dotards. The Normans were unmitigated barbarians. The Plantagenets never evinced any respect for learning. The Tudors were restless tyrants, yet they founded schools, but quite *anti-national*, preferring Latin, &c. to English!

The University of Oxford, in 1839, had 201 Fellow-commoners, 1325 Pensioners, and 43 Students of Law and Medicine. It had, moreover, 24 Heads of Houses, 557 Fellowships, 339 Scholarships, 455 Benefices, 241 Doctors, 2137 Masters of Arts, and 1224 Bachelors. In all, 5264 members, with an aggregate income of about 464,000*l*.

The University of Cambridge, in 1838, had 166 Fellow-commoners, 1321 Pensioners, 146 Sizars, and 141 Ten-year Men. It had, moreover, 17 Heads of Houses, 431 Fellowships, 793 Scholarships, 311 Benefices, 120 Doctors, 2298 Masters of Arts, and 1290 Bachelors. In all, 5575 members. Its aggregate income is 378,000*l*.

Dublin University has 185 Fellow-commoners, 1159 Pensioners, and 42 Sizars; 25 Fellowships, 70 Scholarships, 31 Incumbents, with 1 Head; and revenues about 92,500*l*.

The University of Oxford is governed by a chancellor, high-steward, vice-chancellor, and 4 pro-vice-chancellors. There are 19 colleges and 5 halls, the oldest having been founded in 1172; and the last, Worcester, in 1714. The professors are 27; of whom there are 2 in divinity, 2 in Arabic, and 1 in the equivocal science of political economy.

Cambridge University consists of a chancellor, high steward, and deputy vice-chancellor, a commissary, public orator, librarian, 3 esquire bedels, 24 professors, 2 preachers, and curators of the Botanic Garden and Fitzwilliam Museum. It consists of 13 colleges and 4 halls. Peter-house was formed in 1257; and Downing in 1800.

Though St. Peter's, the oldest college at Cambridge, was founded in 1257, it was a place of education as early as the Romans, but revived in the reign of Henry I.

In 1750, the Oxford students were 190, and, in 1820, 366. In 1748, those of Cambridge were 138, and in 1823 were 397.

Cambridge for the first time had, in 1834, 90 more than Oxford, after exhibiting a progressive advance for several years. The cause is ascribed to the more liberal political character of Cambridge. There has been an extraordinary increase in the members of this university since the middle of the last century.

1748	1590
1813	2805
1825	4700
1830	5263

The number of colleges at Oxford is 24, and that of the professors 28; whilst, at Cambridge, the number of colleges is only 17; and of the professors 24. There are

private teachers and tutors in the several colleges, who are efficient instructors.

The colleges at Cambridge are—

St. Peter's .. .. Built in	1257
Clare-hall	13-6
Pembroke-hall	1343
Bennett's	1356
Caius	1348
Trinity-hall	1400
King's College	1441

The splendid chapel of this college is 316 feet long, and 86 broad, with towers 146 feet high, and a dome, with painted windows, 50 feet high.

Christ's College	1442
Queen's College	1448
Catharine-hall	1475
Jesus' College	1497
St. John's College	1516
Magdalen College	1542
Trinity College	1546
(The largest in the university.)	
Emanuel College	1584
Sydney College	1600
Downing College	1800

There are also, at Cambridge, a splendid senate-house, library, public schools, and a museum. There are 410 fellows—70 to King's, 61 to St. John's, and 60 to Trinity.

Christ-church, Oxford, is the most splendid establishment of its kind.

The foundations were as under:—

University College	1172
Baliol College	1263
St. Edmund-hall	1269
Merton College	1274
Exeter College	1316
Oriel College	1325
St. Mary-hall	1333
Queen's College	1340
New College	1375
New-in-hall	1392
Lincoln College	1427
All Souls' College	1437
Magdalen College	1449
Brazen Nose College	1511
Corpus Christi	1516
Christ-church College	1532
St. Alban-hall	1547
Trinity College	1555
St. John's College	1557
Jesus' College	1571
Magdalen-hall	1602
Wadham College	1613
Pembroke College	1620
Worcester College	1714

There are 4 terms—10 weeks, 5 weeks, 5 weeks, and 9 weeks. There is a chancellor, high-steward, vice-chancellor, 4 pro-vice-chancellors, a deputy-steward, public orator, 2 proctors, 4 pro-proctors, 3 esquire bedels.

SCOTLAND has Universities at Edinburgh, Glasgow, St. Andrew's, and Aberdeen; all in high repute. Aberdeen has two colleges, founded in 1410, St. Salvator's, and St. Mary's, for divinity only. Its students are 150.

Nearly 3000 students, per annum, attend the University at Edinburgh, where education and knowledge are acquired in the highest degree of perfection. Its professors for half a century have been the most distinguished literati of the age.

Between 1800 and 1830, the University of Edinburgh granted 199 degrees in arts, and 2524 in medicine. Glasgow 712 in arts, and 410 in medicine. St. Andrew's 59 and 649. —*Marshal.* Aberdeen 1018 and 282; and King's 740 and 286. In all, 4151 in medicine, and 2728 in arts, or 230 per annum.

Degrees granted by each of the Scottish Universities in the last 31 *years*:—

	D.D.	LL.D.	A.M.	M.D.
Edinburgh	46	27	199	2524
Glasgow	87	72	760	654
St. Andrew's......	69	6	59	649
Aberdeen	26	59	740	286
Marischal	31	50	681	282

About 1600 members are usually resident at Oxford and Cambridge, 800 at Dublin, 2300 at Edinburgh, and 1300 at Glasgow.

The University of Dublin, or Trinity College, has produced very learned men. It consists of a provost, 7 senior, and 18 junior fellows, and 70 foundation scholars. It has usually about 2500 students, and possesses a library 207 feet long, containing nearly 80,000 books.

The Royal College of Maynooth has 9 professors, 1 of dogmatic theology, 1 of moral theology, 1 of sacred scripture, and 1 of Irish.

Oxford confers 434 degrees per annum; Cambridge, 528; Dublin, 370; Edinburgh, 150; Glasgow, 80.—*Jones.*

At Oxford there are 32 professors and lecturers; at Cambridge, 49; at Dublin, 29; in the London University, 52; in all, 273; of which 59 are lectureships.

The members on the books at Edinburgh are 2267; at Glasgow, 1279; at Aberdeen, 640; at St. Andrew's, 327; and at Durham, 220.

In all, there are 52 colleges in the Universities of Great Britain, besides local colleges as King William's, in the Isle of Man; and 5 or 6 others of high reputation.

The revenues of Oxford, from college sources, are 152,670*l.*, and of Cambridge, 133,268*l.* Those of Christ-church, Oxford, and King's and Trinity, Cambridge, are about 22,000*l.* each; those of New College, Oxford, and St. John's, Cambridge, are about 18,000*l.* The revenues of the 70 Fellows of King's are 20,400*l.*; of the 70 of New College are 17,500*l.*; and of 6 others are above 10,000*l.* In Oxford, there are 557 Fellows, and in Cambridge 431, with total revenues of 116,560*l.* and 90,330*l.* respectively. The 24 Heads, at Oxford, divide 18,350*l.*, and the 17 at Cambridge, 12,650*l.* The Head of Christ-church and of Trinity, Cambridge, have 2000*l.* per annum each, and King's, 1600*l.* Oxford has 455 benefices, worth 136,500*l.*; and Cambridge 311, worth 93,300*l.*

Oxford has 5264 members of all degrees, and Cambridge 5575. The D.D. at Oxford are 123, and Cambridge 56. The M.A. at

Oxford 2137, and at Cambridge 2298. The B.A. at Oxford 951, and Cambridge 1015. The Commoners at Oxford are 1325, and the Pensioners at Cambridge are 1321. The Servitors at Oxford are 15, and the Sizars at Cambridge 146. Christ-church, Oxford, has 903 members. Trinity, Cambridge, 1698, and St. John's 1096.—*Jones.*

The revenues of Trinity College, Dublin, are 31,500*l*; the Provost, 2000*l*.; and 26 Fellows, 1000*l*. each. The gross numbers 1624, of whom 1159 are pensioners.

Jones calculates the stimulating forces at Oxford, 106·6; at Cambridge, 66; and at Dublin, 28·7.

The average income of the Professors at Oxford, is 187*l*.; at Cambridge, 181*l*.; at Dublin, 154*l*.; at Edinburgh, 620*l*.; at Glasgow, 554*l*.; at Aberdeen, 204*l*.; at St. Andrew's, 314*l*.; at Dumfries, 293*l*.; and at Durham, 500*l*.—*Jones.*

Oxford prints, of bibles and other books, to the value of 34,000*l*. per annum; and Cambridge 23,721*l*., at a profit of 30 per cent.—*Jones.*

Dublin grants degrees to dissenters, and requires no residence.

Oxford has at its disposal 450 Livings, 24 Headships of Colleges, 570 Fellowships, and hundreds of Scholarships, &c. &c. Cambridge has 330 Livings, 17 Headships, 420 Fellowships, 15 Masterships of Schools, and hundreds of Scholarships, &c. &c.

The subjects on which degrees are granted are, 6 books of Homer, 6 of Virgil, 4 of Euclid, some arithmetic and algebra, Paley's Evidences, and Paley's Moral Philosophy. If the degree is taken with honours, this means a severe examination in differentials, the higher Geometry, &c. Divinity degrees at Cambridge require attendance at the Norrisian course, and honours at Oxford depend on *crams* of divinity and the obsolete languages!

The degrees, with honours, at Oxford, are granted to 4 classes In Literis Humanioribus and In Disciplinis Mathematicis et Physicis. At Cambridge, in mathematics, as wranglers, senior and junior optimes; and, in classics, in three classes.

Winchester School was founded in 1387; Eton in 1441; Manchester, 1510; St Paul's, 1512; Shrewsbury, 1551; Christ's Hospital, 1552; Merchant Taylors', 1561; Rugby, 1567; Harrow, 1585; Westminster, 1590; and Charterhouse, 1611.

Christ's Hospital, London, educates and boards 1200 boys for 30,000*l*. per annum, or 25*l*. each. But the studies are obsolete, and in no respect adapted to modern usage and social wants.

In 1582, a University was founded at Durham, by the bishop.

The University of Durham has a school of civil Engineers, and a school of Mines, subjects of study so important to the welfare of a nation.

The Foundation Schools of Harrow, Westminster, Merchant Taylors', Saint Paul's, the Charter-house, Rugby, and some others have, deservedly, great celebrity; but the subjects of education are those of the age of Elizabeth!

The Number of Young Persons educated at the great Public Schools is as under:—

Christ's Hospital	1200
Eton	500
Charter-house	400
Winchester	250
Westminster	250
Harrow	200

There are colleges at Calcutta, Barbadoes, Windsor, Nova Scotia: and York, Upper Canada.

There are 450 endowed Grammar Schools scattered over England and Wales; but, as above 400 of them were founded in the 16th century, and the monkish and obsolete learning of that age is prescribed by their statutes, they are, for the most part, *utterly useless* to the local population.

The total number receiving daily education in *England* is about 1,200,000, while the children under 15 cannot be computed at less than 4,000,000. Those who receive early education in the nursery, and children of the rich, educated at home, 500,000, there remain 3,000,000 children for public schools.

The returns of 1,200,000 include every college, boarding-school, grammar-school, endowed-school, preparatory-school, and dame-school.

The number frequenting Sunday-schools, is 1,548,890; the majority are included among those receiving daily instruction.

The whole number of schools and scholars is shewn by the following abstract:—

ENGLAND AND WALES.

	Schools.	Scholars.
Infant	2,985	89,005
Daily	35,986	1,187,942
Total	38,971	1,276,947

	By Endowment.		By Subscription.	
	Schools.	Scholars.	Schools.	Scholars.
Infant & Daily ..	4,106	153,764	2,829	178,517

	By Payment.		By Subscription and Payment	
	Schools.	Scholars.	Schools.	Scholars.
Infant & Daily ..	29,141	732,449	2,895	212,217

There were educated in England and Wales, in 1829—

National Union ..	280,688
British and Foreign	52,998
Sabbath Union ..	690,517

The charitable bequests in support of schools were 71,888*l*.

Annual income of endowed public charities, 1,089,265*l.*

The first duty of a State is to provide for the instruction of the people. The most useful and essential of all contributions, is the contribution of knowledge.

The proportion of the population educated at schools:—

In England..........	1 in 17
Wales..............	1 in 20
Scotland............	1 in 9
Holland............	1 in 10
Switzerland........	1 in 8
France..............	1 in 14

Of 11,000 parishes in England, 3500 were, in 1820, without a school.

In 1818, there were in England 4167 endowed-schools, 14 282 unendowed schools, and 5162 Sunday-schools. The revenue of the endowed was 300,525*l.*, not, perhaps, a fourth of the true amount. At that time, the whole educated but 644,000 children.

The British and Foreign School Society has 86 schools in and round London, in which 14,000 children are educated. 1,500,000 children are educated at Sunday-schools in Great Britain, at a cost of 2*s.* each per annum

The 50,000 schools in Great Britain consist of 30,000, aided by charitable funds; and 20,000 independent, in 10,000 of which no regular system is adopted; in 1000, the system of Bell and Lancaster is adopted.

The National Schools, in the spring of 1830, educated 275,000 children; the Lancasterian, 53,000; and there were 5000 Sunday Schools, for 700,000 children.

There are three methods of acquiring knowledge,—first, by committing to memory in the manner of tasks, which usually are forgotten as soon as said by rote; second, reading books, which makes but a fleeting impression, and leaves only general ideas; and third, answering, by original exercise, questions upon books, and on the facts and principles contained in them, by which the student is compelled to think for himself, and to evince his acquaintance with the subject. This is called *the Interrogative system*, and it has been applied to every subject of study, with unequivocal success, by Sir Richard Phillips.

The system of Pestalozzi consists of oral questions, proceeding systematically from simple to complicated objects, and the answers are given orally. It is similar to the interrogative system, but does not possess the practical convenience and intellectual advantages which attend the writing of the answers, which act is a simultaneous exercise in spelling, grammar, and composition.

The system of Bell and Lancaster is an appeal to the eye and memory, in small classes, directed by monitors, who are the more forward children, and who perfect themselves while teaching the others, so that one master may thus superintend the economy and exercises of several hundred pupils; and it is, therefore, a cheap method of teaching the mass of the juvenile population the first elements of knowledge.

The most universal and unexceptionable of all mental propositions, is that which ascribes intellectual and bodily improvement to exercises and reiterations of exercises. There can be *no other* means of acquiring knowledge, and all other pretences are vain. The practical system which carries out this principle, is that called *the Interrogative.* And its only enemies are vain quacks, who remain in ignorance of this great fundamental principle.

The number of children or youths in the United Kingdom, between 5 and 14 years of age, are about 6 000,000; the whole require from 80,000 to 100,000 teachers.

A modern Italian traveller ascribes the rapid march of intellect in England to the almost general use of Blair's Universal Preceptor, one of the best books on the Interrogative system. The Registers of the same author have also greatly increased the useful spirit of emulation in all schools. There has, in fact, been no improvement in education within the last half century, but in the introduction of the Interrogative system.

No single teacher can properly conduct the studies of more than 30 or 40 pupils. At 6 hours per day, this is but 12 minutes or 9 minutes to each; and much must be due to emulation and good system. Then, a moderate income of 150*l.* or 160*l.* a year demands 5*l.* or 4*l.* from each, with, at least, 2*l.* for books, &c. Yet, how many are obliged to be content with 6*d.* a week, and how many announce board and education at 18*l.* and 20*l.* a year! How monstrous, then, for insolent theorists to vilify teachers, when patronage is so incompetent, and when government prefer the sword to the schoolmaster, and pay 100,000 fighting-men 60*l.* each a year, instead of 120*l.* to half the number of formers of good subjects.

The system of teaching languages by words, phrases, and grammar, in consecutive succession, as in the nursery, was first published, in 1803, in elementary works, under the assumed name of the Abbé Bossut. The recurring words of every language are the prepositions, conjunctions, and adverbs, and the easy task of learning these is half the acquirement of every language.

In despite of the monkish grammar-schools, and their endowments, nearly every populous district has now its collegiate school, its proprietary school, &c., generally well supported. Six-penny schools of the last generation are thus converted into others, on which ten and twenty guineas per annum are paid for daily instruction.

Gresham College, sadly deteriorated, has 7 professors of branches of ancient learning, who lecture in term-time. It is under the direction of 12 of the corporation of London.

There are endowed colleges at Dulwich, Eton, St. Bee's, St. David's, and Winchester: besides the Military, Naval, East India, and Sion; Elizabeth, in Guernsey; and King William's, in the Isle of Man.

Two new colleges, on the plan suggested by Defoe, have recently been established in London, one called the London Univer-

sity, near Tottenham Court; and the other, King's College, in Somerset-House.

The University of Gottingen, now deservedly famous, was founded by George II. in 1735. It has thirty-six professors, many of whom are constantly at the European head of their branch of learning. Gauss, Blumenbach, Hugo, Eickhorn, Tyschen, Heeren, and Sartorius, are contemporary professors. The library contains 200,000 useful books. Gottingen had 913 students in Jan. 1832.

There are 24 German Universities. That of Berlin has 1800 students; Leipsic, 1436; Munich, 1329; Prague, 1449; and Vienna, 1954. Halle and Gottingen have nearly 900 each.

In five parishes of Westminster, namely, St. Martin's, St. Clement Danes, St. Mary-le-Strand, St. Paul's, Covent Garden, and the Savoy, there is a population of 42,996. There are in St. Martin's 49 schools, attended by 2131 scholars.

In St. Clement's, 34 schools, with 1116 scholars.

In St. Mary-le-Strand, 11 schools, with 478 scholars.

In St. Paul's, 20 schools, 999 scholars.

In the Savoy, 2 schools, 46 scholars.

Making the total number of schools in the 5 parishes of this district 116, and the total number of their pupils 4770. Of the whole, 666 attend only sunday-schools, 340 are in dame-schools, where only a little spelling and reading are acquired. 784 attend common day-schools, in which they acquire reading, writing, and arithmetic. 510 in schools of the middling class, with 87 in evening schools, acquire grammar, history, and geography, in an imperfect manner; and 525 in superior schools have the opportunity of receiving a general education. 660 are in infant schools, and 735 children are in national and parochial schools; and 466 are in other charity and endowed-schools, making the 4770.

While these sheets are printing, a public advertisement announces commercial education on the principles of the Church of England; at the head of the subscribers to which, is the Archbishop of Canterbury! This bespeaks a weak and morbid jealousy, for it is difficult to imagine the assumed connection of book-keeping, arithmetic, &c. with any church or sect; and, shoe-making, tailoring, grocery, &c. may, with equal reason, be connected in Cathedral boots, Unitarian breeches, or Wesleyan sugar. Such a narrow-minded system of exclusion, of course, defeats itself, and renders the least exceptionable cause ridiculous.

In 1832, in a Bible visit to 41,017 adult individuals, in Herefordshire, it was found that 19,795 could not read; but of 60,000, in Massachusets, only 400 were unable to read and write.

In the parish of Siddlesham, in Sussex, out of 288 adults of both sexes, belonging to the agricultural class, 95, or one-third, were unable to read; but the proportion among the miscellaneous classes was but one-eighth.

The voluntary contributions to education are—

	1829	1835
British and Foreign Bible Society	65,261*l.*	107,926*l.*
Religious Tract Society	——	56,370*l.*
Missionary Societies.		
Church - - -	41,146*l.*	*a* 69,582*l.*
London - - -	34,712*l.*	*b* 57,895*l.*
Wesleyan - - -	39,4.6*l.*	60,665*l.*
Baptist - - -	9278*l.*	——
a Includes a legacy of - -		11 000*l.*
b Ditto - - - -		7,000*l.*

In Austria, universal education is prescribed by authority. Every village has a school, and no man can marry, or get employment, who cannot read and write. In Hungary, &c. there are 25 000 public schools, which instruct 2½ million.

Austria has 8 universities, containing 670 professors and 20,603 students of all grades.

In 1828, the University of Berlin had 1706 students.

There are 400 students at the University of Kiel.

In the Russian universities there are students:—Moscow, 891; Dorpat, 612; Helsingfoers (late Abo), 471; Charkoff, 318; Wilna, 303; St. Petersburgh, 311; and Kasan, 81. The ecclesiastical high-schools, attached to the Greek Church, are those of Kioff, Moscow, and St. Petersburgh, of which the first possesses 1500, the second 630, and the last 830 scholars. The whole of the students throughout the Russian empire are, therefore, 5957 in number.

The University of Cracow was abolished by the jealousy of Austria, in 1806; and more supple ones founded at Leopol and Warsaw, in 1832.

Sweden has 3 Universities, with 2500 students; Russia 6, with 2000 students; Denmark 2, with 900 students; Belgium 4, with 1200 students; Holland 3, with 1520 students; Prussia has 7, with 5900 students; Hanover 1, (Gottingen), with 820 students; Saxony 1, (Leipsic), with 1440 students; Wurtemberg 1, (Tubingen), with 660 students; Bavaria 3, with 20 0 students; Austria 9, with 8100 students; Portugal 1, with 1600 students; Sardinia 4, with 1800 students; Naples 3, with 2100 students; United States, 92 colleges, and about 10,000 students.

In the Italian Universities, ladies of competent learning take degrees; and there are several instances of female professors.

The principal colleges in the United States are Yale, Harwood, Dartmouth, Amherst, Union, and Prince-town.

The University of France consists of 26 academies, or local universities, in Paris and the departments. These branch into royal colleges, and commonial colleges, all under the general direction of a royal council of 6, whose president is the minister of public instruction. The 41 royal colleges have 626 professors, and about 15 000 students and graduates; and below these are 42,318 primary schools. The 41 chief colleges are

also endowed with 1114 pensions for students, and, connected with them are 54 normal schools to rear teachers for the 42,318 primary schools, in which, in winter and spring, 4 millions of children are taught. The entire system resembles a cotton-mill, from its balance-lever to its thousands of spoles and spindles, in a perfect republic of learning.

The French system of public instruction has 107 commissions of examination, 511 committees of districts, 76 normal schools for instructing 2517 teachers, 278 superior primary schools, of which 51 are private, educating 7198. The commercial elementary schools are 28,185 for boys, and 4679 for girls. There are, besides, 16,337 private schools for boys or girls. The boys who attended all, in 1837, were 1,388,964, and 943,616 girls. The public expences, in 1838, were 1,000,000 of francs (360,000*l.*) for the commercial schools, *i. e.* about 7 francs per scholar per annum. The pupils to the boys' schools were about 40 each, and from 50 to 60 in the girls. There were, also, 247 infant-schools, which received 26,000 children. The elementary books, on 21 subjects, are sold at 2*d.* each, English. The whole are under the local superintendence of 26 academies, with a rector, inspectors, and secretary.

Prussia and Saxony have systems of general public education, supported by rates on the whole population, and under the direction of cabinet ministers of public instruction. In Prussia, parents are fined for the non-attendance of children; and every parish has a school for elementary knowledge, with grades in districts for higher branches. The systems work well and advantageously in the 10 divisions of the Prussian monarchy; and in each there is a university as a finish to the whole. No ecclesiastics are allowed to mix with the system, but there may be schools for sects, Jews, &c. but all must pay to the national system. There are, also, private schools of all kinds for fancy subjects; but, whatever be the form, attendance is enforced by law. In Saxony, the clergy are permitted to be on committees; but, as there are no uniform tenets among protestant reformers, so this creates no differences. The assessments are trifling, and the salaries to schoolmasters, besides house, &c. vary from 10 to 100 dollars or more a month, according to circumstances and duties.—*Cousins.*

Russia, Sweden, and Denmark, have somewhat similar systems; so that all these nations can now read, write, cypher, and construe their own language. If they learn any other language, it is some modern one, the obsolete languages of Latin and Greek being rejected as a waste of labour, and a useless exhaustion of mind. Catholic Bohemia has a similar system, and all children from 6 to 12 are compelled to attend the parish schools.

Public instruction is, also, a perfect system in the United States. In that of New York only, there are 9062 schools, which instruct half a million of children, at the public expence, and these are directed by 4 colleges, and 57 incorporated academies.

Education, in America, is a state affair. There are schools for all, free of personal expence, and reserves are made of public lands, to keep pace with population. Common schools, therefore, are open to all; and, in every state, colleges or universities at a gross expence of 18*l.* or 24*l.* a year. Before the American Revolution, in 1776, only ten colleges had been established in the colonies; but the whole number of colleges and universities, now existing in the United States, is upwards of sixty. In the Eastern or New England States, and the State of New York, the counties are divided into townships, which are subdivided into school districts of convenient size; and in these districts common schools are maintained, at least, a part of the year, to which all the inhabitants, both rich and poor, have an equal right to send their children for instruction.

Russia is provided with a general system of popular instruction, and the attendance is about 1 million, or a fiftieth of the population. We have heard of no Russian discoveries, though the publications are numerous. The men of letters, and professors, are chiefly Germans, French, and English.

An attempt has been made, by Jacotot, of Louvain, to connect with education the ten categories of Aristotle, and the five logical rules of conception. It is a revival of the system of the dark ages, and resembles the Swiss systems of Pestalozzi and Fellenberg. Children are, as to every idea, to discriminate the substance, quantity, quality, relation, action, passion, where, when, situation, and clothing!

Nothing can be more despicable than the policy of modern rulers on the subject of public instruction. They concede pounds where tens are required, and seem to consider the creation of intelligent subjects as no gain to the community. Dealers in slaves know better; they value a well-educated slave at 100*l.*, and an untaught one at only 25*l.* or 30*l.*

Learning is the preceptor's stock in trade, and he deals in that stock of which he has the largest supply. Hence it is that so many obsolete reliques of the learning of past ages are forced into the studies of youth.

The Editor, in a tour among schools, found that endowments, of 5 or 600*l.* a year, were often enjoyed only by *hiring* a few children for show, while in others the schools were kept open only by the gratuitous classes. To keep children out of mischief is the chief use of all such schools. Instead of useful living instruction, the sole object is to fill up six or seven years with obsolete studies.

In 100 questions lately put to classes of boys and girls differently educated, the boys taught according to the method of the *Interrogative System* answered 85, and the girls 71; but, in the classes educated by the ordinary methods of teaching by rote, the boys answered only 28, and the girls but 18. Five minutes were allowed, if necessary, to each question; and each class consisted of

six, from 12 to 15 years old. The difference of intelligence in the boys was above 3 to 1, and in the girls nearly as 4 to 1.

By a manœuvre of the Catholic party, in the governments of Henry VIII. and Elizabeth, it was contrived, under the plausible name of education, to set up schools to teach Latin, so that on a hoped-for change of religion, a large portion of the population might be prepared to attend mass. This was the origin of the free-schools in which Latin only is taught, or just as much as fits the scholars for the mass, for this is its only use in a country where even law, physic, and divinity, are practised in the mother-tongue.

For the same reason, it was contrived that all the literary exercises in our Universities were to be in the Catholic language of Latin.

The Editor of this Volume first shewed the connection of ignorance with crime, by an examination of Newgate, in 1807; and theorists have subsequently pursued the same subject. French economists have so far refined, as to produce an annual official developement. It appears that where there is the least instruction there is 5, 6, or 7 times more crime. Thus, the proportion of the convicted were 644 of the ignorant, 295 of those who had been partially disciplined in schools, 87 in the educated, and only 15 of those of superior education. Again, it appeared that, of 4222 criminals, 3777 were such as had received no instruction, and only 100 had received a superior education.

The scholastic profession, nearly 100,000 in number, have been slandered in the legislature, because some dozen or score of improper characters have set up for teachers, as though there were no recreant peers or ignorant members of the House of Commons.

ARCHEOLOGY & ARCHITECTURE.

The first habitations of mankind were cabins, grottoes, or caves. Improvements in these spread from the East to West. Virgil says, that before Troy and Pergamean citadels existed, men dwelt in caves in the bottoms of vallies. Some of these early cavern-dwellings still exist at Ipsica, in Sicily. On the Syrian coast, and South of Lebanon, there was lately visited an extensive subterranean city, constructed like a bee-hive. Mud-buildings were imitations of the martin's nest; and Plutarch mentions cottages made of frame-work and mud. But Sanchoniatho, quoted in Ancient History, gives us notices of the first improvers.

Caves in rocks, like those at Nottingham, and in India; or holes in the ground, like those on the North-west coast of America; the tents of the Arabs, the kraals of Hottentots, and the wigwams of North American Indians, were the first habitations.

Towns originally were fortresses, to which rustics retired with their cattle, when there was danger from the incursion of enemies.

The Asiatics traditionally speak of Balkh as the mother of cities. Its ruins cover several square miles, but its present population is reduced to 2000. The Hindoos claim extreme antiquity for Benares and Canora. But Sanchoniatho affirms that Byblos was the first town built.

Banian is the name of a city in Great Bucharia, held in great veneration by the Hindoos as the fountain of Buddhaism. They say it was built by Sham, who was an incarnation of Vishnu. It is cut in a mountain; and there are 12 000 recesses or habitations, some very large, like the nests of sea-fowls in cliffs. Near it are two statues 80 or 90 feet high, and another 20 feet high, called Schahama and Salsala.

The *Cyclopean Style*, from its extraordinary magnitude, is ascribed to the early Cyclops, men who, from their power, prowess, and mighty works, are believed to have been the giants and Titans of Isaiah. The general character of the Cyclopean style, was immense blocks without cement.

Hamilton divides this style into four eras; the *first*, or oldest, is that used at Tiryns and Mycenæ, consisting of blocks of various sizes, of which the interstices are, or were, filled up with small stones.

The *second* era, as at Iulis and Delphi, of polygonal stones, which fit into each other.

The *third* style, as in the Phocian cities, and in some of Bœotia and Argolis, distinguished by the work being made in courses, and the stones of the same height.

The *fourth* presents horizontal courses of masonry, formed of rectangular stones.

Pliny says, that the Cyclops were the *inventors* of the fortifications of towns, and also of towers. Tiryns is the best specimen, and Homer calls it the well-walled Tirynthus, so that the present ruins are those which existed in the time of the poet.

Apollodorus says, that Perseus fortified Tiryns and Myceuæ. The Gate of the Lions, says Pausanias, is the work of the Cyclops, and the lions are the only existing specimens of the sculpture of those ages. They have no tails, a circumstance observable, also, in the sculptures of Persepolis, where animals very like those of Mycenæ are represented. There can be little doubt that the fraternal association of Masons originated in the travelling jobs of the cyclops and early builders. The stories about *one eye*, &c. &c. are to be regarded as vulgar fables.

The Cyclopean masonry was not limited to Greece. Two fine specimens occur in Italy, at Ausidonia and Saturnia, towns anterior to Rome.

The style anterior to the Cyclopean age exists in the remains at Salsette, Elephanta, Canora, and Elora. They are caverns cut out of a rocky hill, and shaped into courts, supported by parts of the rock, formed into columns, with cushion-like capitals. The sides are filled with bas-reliefs, so prominent, that they are joined to the rock only by the back. All the figures are colossal.

The Cyclopean was improved in Egyptian architecture, which also astonishes by massive grandeur. It consists of enormous blocks, thick columns, walls narrowing upwards, with immense impending cornices,

but no pediments, because, as it never rains in Egypt, there was no necessity for roofs.

The earliest Egyptian column was simply a stalk of the lotus, topped by its calix. The lotus reigned every where. The calix of a flower above a bundle of its stalks, suggested the form of the column, base, and capital. But all the ornaments are heavy, and offer no repose. Every thing was upon a grand scale, suited only to despots and conquerors. Their buildings are characterized by forests of columns, avenues of sphinxes, lions, or rams, all colossal. They also made large moles, with immense colossal statues in front of them, with obelisks, gate-ways preceded by avenues, and detached from the moles which flanked.

Strabo joins Herodotus in saying, that the Egyptians and Phœnicians were the first who erected temples, but the Indian caverns are more ancient, and of unknown origin.

Denon gives the general plan of the great temples: 1. An avenue of sphinxes. 2. Two colossal figures on each side of a gateway, formed by immense towers of truncated pyramids, with overhanging cornices. 3. This gateway led into a court full of columns, and chambers round the walls. 4. Passing across this, there are other courts, likewise full of columns, through gateways, ornamented with colossal figures and obelisks. 5. In the centre was the sanctuary, without light, consisting of a single excavated block One of them, at the temple of Latona, was 71 feet broad in front, carved out of one entire stone, and roofed by another.

Sesostris is said to have brought from the mountains of Arabia a rock 32 feet broad, and 240 long. Herodotus mentions one more than 33 feet broad, and 100 long, conveyed from Elephanta by a journey of 20 days. The general rule for determining the age of Egyptian temples is their size. The smaller are the more ancient.

The tombs at Thebes consist of sepulchral grottoes, made in the side of a hill, from its base to within three quarters of its summit. The lowest are the best executed, and the most spacious. A door open to the east leads to a gallery supported by columns or pilasters. At the end of the gallery is a well, which leads to the catacombs, where the mummies were deposited. These wells, from 40 to 60 feet deep, abut upon long subterranean alleys, terminating in a square room, supported by pillars. In the upper gallery are bas-reliefs, or paintings on subjects relating to the funeral ceremonies; and every grotto had a ceiling painted in a fanciful manner. These souterrains in fresco paintings exhibit exactly all the arts which then existed in Egypt, as manufactures and agriculture, carriages, pottery, counters for trade, rural employments, hunting, fishing, marches of troops, punishments, musical instruments, and furniture.

Sesostris placed in the temple of Memphis, colossal figures of himself and his wife, 50 feet high; and of his children, 28 feet.

The largest of the Pyramids is 513 feet high, and 693 feet on the sides; its base covers 11 acres. Many of the stones are above 30 feet in length, 4 broad, and 3 thick; and the layers are 208.

The Pyramids of Egypt have been opened, (like those at Elora, &c.) but without particular discovery. Besides passages and empty chambers in the great Pyramid, 66 feet by 27, in an upper chamber, 36 feet by 18 and 19 high, there was found a sarcophagus. Similar chambers were found empty in smaller pyramids, but sometimes containing images and rude sculptures. Belzoni penetrated the second pyramid of Chesroes, and found a chamber, 46 feet by 16, and 24 feet high, with a sarcophagus, and an inscription certifying that it had been opened by Mahomet I.

Thebes, in Egypt, presents ruins 27 miles round. It had 100 gates.

Herodotus gives a romantic description of the Royal Labyrinth of Egypt. Within a walled enclosure were 12 palaces, each containing 3000 halls, 12 of great beauty, and half above and half under ground. He says, he visited all above ground, but was not permitted to view the subterranean part. The whole was of white marble, and filled with sculpture. We may presume, that in this, as in other instances, Herodotus was a mendacious traveller, sporting with the credulity of the Greeks, for no remains of such edifices have ever been traced, and royal absurdity could scarcely have been carried to such a pitch!

The lake Mœris, in Egypt, anciently described as an artificial wonder, 450 miles round, and 300 feet deep, is now but 35 miles long and 6 broad, and believed to be a natural lake.

At Thebes, the coffins of *mummies* are burnt for fire-wood, and every where limestone *ruins* are burnt for lime.

Philœ says, Madden is a delightful garden studded with temples and obelisks. Osiris, or Dagon, was buried there. The same enlightened traveller classes the sea-view of Constantinople, the Coliseum by moonlight, Vesuvius at sun-rise, and Philœ, as sights affording eternal pleasure.

Nubia is a strip of land 4 or 500 miles long, and 1, 2, or 3 broad, on each side the Nile, and very fertile. It contains 19 ruined temples, of primitive antiquity, 159 villages, and about 100,000 black inhabitants, with Hindoo features.

The Oasis of Thebes, five days' journey across the desert west of Cairo, abounds in villages, with several ancient temples, Egyptian, Greek, and Roman. There is a second most fertile and beautiful oasis, 100 miles south-west, of 12 villages, with temples and ruins, called the Valley of Dakel.

The dryness of the atmosphere preserves every thing in Egypt. The chalk-marks of builders are perfect after 4000 years.

The Portico of Hermopolis is 120 feet long, and 60 high, and the columns have lotus capitals 35 feet round. The architrave is but 5 stones, each 22 feet long.

The Temple of Ypsambul, in Nubia, is cut out of a solid rock, and of vast dimen-

sions. Belzoni found in it 4 colossal figures 65 feet high, 25 feet across the shoulders, the face 7 feet, and the ear above a yard.

The French have removed from Thebes the great red granite column 95 feet high, weighing 210 tons, and carried it to Paris. Its companion, given to the British government, is still at Thebes: as well as Cleopatra's Needle.

Pompey's pillar is 92 feet high, and 27½ round at the base. The Arabs call it the Pillar of the Colonnades, once surrounded.

English and Italian excavators dug out the great Sphinx, and found that it was sculptured from the solid rock, the paws only being put on by masonry.

The Sepoys, who accompanied Baird's expedition to Egypt, paid reverence to the colossal figures on the temples, as connected with their ideas about Vishnu.

Babel, or *Baalbel*, was a lofty temple built at Babylon, by Belus, both as an observatory, and a temple of the Sun. Its remains are in existence, under the name of Birs Nimrod. It was finished in 8 square towers, one on the other, 660 feet high, and the same at each side of its base, (*i. e.* half as high again as St. Paul's.) Lately, its heighth was 141 feet, and the reeds, between every 3 or 4 layers of brick, were fresh, while the brick is calcined by fire.

Babylon continued, for 2000 years after, to be the most splendid city in the world, and so Alexander found it as late as 325 B. C. It was a square, 15 miles on each side, with 100 brass gates. It was composed of 25 streets each way, 15 miles long, and 150 feet broad, crossing each other at right angles, besides 4 half-streets, 200 feet wide, facing the walls, in detached houses, with gardens and pleasure-grounds. The walls were 87 feet thick, and 370 high. So says Herodotus, and other ancients who saw it; but the whole must be exaggerated, for 15 miles each way would be 225 square miles; and London does not cover 32. It must have been equal to Middlesex, and its walls as high as St. Paul's. The palace, the hanging-gardens, the artificial lake, 40 miles square, and 6 fathoms deep, as well as the temple of Belus, or Baal, with a golden image, 40 feet high, valued at 3½ millions sterling, all savour of eastern exaggeration.

In 540 B. C. it was besieged by Cyrus, but being provisioned for 20 years, he blockaded it for 2 years, and then took it by fording the river during a festival. In 518, under Darius, it revolted, and being re-taken, its 100 gates and walls were destroyed. In 478, Xerxes plundered the temple, and demolished its lofty tower. In 324, Alexander began to re-build it, and employed 10,000 men for two months. Thirty years after, Seleucus built Seleucia near it, and drew off its inhabitants, so that, in 650 years after, Jerome describes it as deserted.

The palace of the kings of Babylon is still so called by the natives, under the name of the *Ksar*. It is a vast mass, 700 yards each way. The walls are 8 feet thick, one within another, and strengthened with buttresses.

There is also another extensive ruin, called *Amran*, three quarters of a mile long, and half a mile broad, which rises 50 or 60 feet above the level of the plain.

A third mass is called the *Muljelibe*, which is considered to be the remains of the tower of Belus; the sides are from 200 to 150 yards, and the present elevation is 14. feet. The ruins are immense, consisting of pottery, vitrified brick, bitumen, &c.

The Tigris was within the kingdom of Cronus, and being given by him to his son Belus, he founded or enlarged Babylon; but, as the site was exposed to inundations of the Euphrates and Tigris, he raised the vast tower for the threefold purpose of retreat from inundations, as an observatory, and as a Temple of the Sun.

The three former buildings are on the eastern bank, and the *Birs Nimroud* on the western side of the Euphrates.

Rich, Porter, Buckingham, and Mignan, confirm the idea that the Birs Nimroud is the remains of the Tower of Babel. Three or four of its seven stories are easily traced. The Muljelibé is believed to be the hanging-gardens, and the Ksar the famed palace. The masonry of the tower, Rich says, is superior to any thing he had ever seen.

Among the ruins are found bricks covered with arrowed inscriptions in the Zend language, ill understood in our time.

In raising the city, Belus was aided by the Titans and Cyclops; but when the Rhea party made war on Astarte and the Titanides, Belus marched to their aid, and the work was interrupted; though we have the testimony of all history, that it was afterwards completed. As a vast work, it was in the taste of a family and age which raised those vast structures in Egypt.

Homer makes it a charge of the gods of Olympus against the Titans of Asia, that they were scaling heaven, nearly in the very words used in Genesis. But if Belus ever ascended any mountain, he would laugh to scorn the insinuations against his pigmy temple, which was to the neighbouring Himalayas as 600 to 26,000 feet!

The modern name *Birs Nimroud* is not intelligible, since Ur or Orfa, his presumed capital, was 1000 miles north-east, and we there find the remains of his palace, and many objects bearing his name, in the country of the Culdees, mistranslated Chaldees.

The whole lie north of Hellah, 9 miles from Mohawil, and 48 from Bagdad; and, for their age, are wonderfully preserved. Among the ruins is a very ancient tree, believed to exist when the city was inhabited.

After the city decayed, it served as a park for hunting to the kings of Persia.

Nineveh was 15 miles by 9, and 40 round, with walls 100 feet high, and thick enough for three chariots abreast.

The most astonishing collection of ruins, of finished and costly architecture in the world, is at Balbec, in the valley between Libanus and anti-Libanus. The platform on which is raised a temple to Baal, or the Sun, contains stones 30 feet above the level, more

than 60 feet long, 24 thick, and 16 broad, *i. e.* each containing 23 000 cubic feet, each foot 2½ cwt., and each stone 2500 tons, squared, sculptured, and brought from distant quarries! Six columns are 72 feet high, formed of 3 stones, 7 feet in diameter, with finished Corinthian capitals and friezes. The whole must be referred to the heroic ages, to Phœnician capital, or to that race of giants, who formerly, on every authority, occupied the mountains of Lebanon.

Three stones still remain in a wall at Balbec, 63, 64, and 67 feet long. In the time of Solomon it was called Baalath, but it was not built by him. It dates, no doubt, from ages of Sanchoniatho, and the god-kings of those countries before the mythology of Taautus.

Ammon, the capital of the Ammonites, since called Philadelphia, is now in splendid ruins, like Pera, and numberless other cities.

The houses of Hauran are universally built of blackened stones and volcanic materials; and extinct craters are distinguished in various places.

Streets in old Asiatic countries mean what are called courts in London, and carriages are unknown. In the principal streets of Jerusalem, Cairo, Bagdad, &c., two camels can scarcely pass one another.

Arab tents, which are now as they were three thousand years ago, are pitched in camps, and are under the authority of a sheik. They are of black or brown stuff, made of camels' or goats' hair.

The wall which separates China from Tartary has been built full two thousand years, and is supposed to be upwards of 1200 miles in length. Its heighth varies according to the circumstances of the surface. It is upwards of 30 feet high, and about 24 thick. The superstructure is brick, and the centre is a kind of mortar, covered with flag-stones. A parapet runs on each side of an embattled wall. This immense fabric crosses the widest rivers, on arches of proportionate size, and connects mountains together, occasionally ascending the highest hills, or descending into the deepest vales! In every situation, however, the passage along it is easy and uninterrupted: and it serves as a military way from one end of China to the other. At proper intervals there are strong towers placed, from whence signals are repeated, and an alarm may be communicated to distant parts of the Empire, with the expedition of the telegraph.—*Macartney.*

The Porcelain Pagoda, or Temple of Gratitude, at Nan-king, was begun in 1403, and finished in 1432. It cost 2,485,484 ounces of silver. The globe at the top cost 48 kin (64lbs.) of gold, and 1400 kin (1866 lbs.) of copper, and is 36 che (42 feet) round. There are 81 iron bells of 16 lbs. It has 8 sides, and is 240 che (280 feet) round. The 9 stories are 228 che (266 feet) high, and the pinnacle is 127 che (148 feet) above the highest story. There are 49 lamps, burning each, per night, a kin (16 oz.) of oil, whose splendour reaches the 33d heaven!! The priests are 800, and the enclosure is 771 *mou*, (about 760 acres.) It has been twice struck by lightning, which the priests call "the god of thunder pursuing a monstrous dragon into the temple."

The East abounds in vast structures. To describe them would fill volumes, but they very strikingly illustrate oriental despotism, pride, and slavery.

The excavations at Salcette, 10 miles N. of Bombay, would employ 40,000 men for 40 years. There are three or four others of equal dimensions. There is also an excavated pagoda 40 feet high, 54 deep, and 44 broad, cut out of a mountain; and, as a structure, perfect!

Two enormous pillars have been discovered in India, one on the Gunduc, near Rasserah, and the other at Allahabad, which seem to be the remains of the pillars of Bacchus or Sesostris. The first is 363 feet in diameter at the base, sustaining a frustrum 93 feet high, on which are the remains of a cylinder 64 feet in diameter, and still 65 feet standing. That at Allahabad is covered with inscriptions, undecyphered!

The Temple of Shoomadoo, at Pegu, is raised on two platforms or terraces, 10 feet and 20 feet high. It is an octagonal cone or pyramid, and each side is 162 feet, without any opening.

Among the splendid tombs in Agra is that of the wife of Sha-gehan, which employed 20,000 artists and workmen for 22 years. It is of black and white marble, and has three platforms, with four towers, and a dome.

The length of Solomon's Temple, built between the years 1005 and 1014 B.C., was 60 cubits, or 107 feet, the breadth 20 or 36 feet, and the heighth 30 or 54 feet. The porch was 20 cubits, or 36 feet long, and the breadth 10 cubits, or 18 feet. Though extolled as one of the wonders of the ancient world, it did not surpass our larger sort of private houses.—*Smith's Michaelis.*

The Caaba, now the Temple of Mecca, was the ancient Temple of the Arabs, with 360 idols, one for every degree, and the statue of Hobab, with seven arrows for the planets. This worship was established by Saba, who called himself Servant of the Sun, and was the founder of *Sabeanism*, which once extended over Asia. They built temples to the seven planets, the 12 signs, and 24 principal constellations. They reverenced the Book of Seth, who divided the zodiac, taught the aspects, assigned the virtues of the planets, &c.

The Caaba is now called *El Harram*, or Inviolable, and itself is a stone edifice within the temple, of extreme antiquity, and held in such sanctity that the Mahometans, in their prayers, always direct their faces towards it. The floor is raised six feet, and a door and window admit light. They say it was built by Adam, and rebuilt by Abraham and Ishmael: and they show the place where he stood, now enclosed with iron; also the tomb of Ishmael, and a black stone, given by Gabriel to Mahomet!

The Temple of Diana, at Ephesus, was 425 feet long, and 225 broad, with 127 co-

lumns, 60 feet high, to support the roof. It was 220 years building. In it stood her mean statue, in wood, representing a female with many paps. It was rebuilt seven times. In 356, on the day Alexander was born, it was burnt by an incendiary. To rebuild it employed 220 years. The columns were of Parian marble, furnished by princes, and curiously sculptured, each 150 tons. Internally, it was decorated with gold, paintings, and statues by the great masters—Scopas, Apelles, Praxiteles, Parrhasius, and the female Timarete. The priests were emasculated, and the sacred virgins were of the highest birth. It was finally destroyed by the Goths, in 260. The Turks, in 1300, finished the overthrow of all its edifices, and Ephesus itself is now deserted for Ajasoleck.

The Greeks and Romans, working in marble instead of sandstone, limestone, and granite, introduced more taste and precision into their structures than the Cyclops and Egyptians, who preceded them. They invented or copied, from the Etruscans and Cretans, five orders of architecture; the Tuscan, Doric, Ionic, Corinthian, and Composite; to which we now add the Gothic, Oriental, Egyptian, and Chinese styles.

The construction of temples was adapted by the ancients to the nature and functions of the deities. Those of Jupiter Fulminans, Cœlum, the Sun, Moon, and Deus-Fideus, were uncovered. The temples of Minerva, Mars, and Hercules, were of the Doric order. The Corinthian was employed for Venus, Flora, Proserpine, and the aquatic Nymphs. The Ionic was used in the temples of Juno, Diana, and Bacchus.

The Temple of Delphos, the first of stone, was so rich in donations, that it was once plundered of 10,000 talents, or 2¼ millions sterling; and Nero carried from it 500 statues. It was built by Agamedes, in 600 B. C.; and at the same time the Temple of Diana was built at Ephesus by Chersiphran. It was rebuilt in 330, by Dinochares.

The Temple in the island of Delos, the reputed birth-place of the twins of Latona, Apollo, and Diana, by Jupiter, king of Crete, was by sundry enlargements the noblest edifice of antiquity.

The Acropolis of Athens was the upper city, in which stood the Temple of Minerva, or Parthenon. The Venetians, in 1687, did greater mischief to the ruins of Athens than the Vandals, Goths, and Turks.

The Temple of Jupiter Olympus, at Athens, was finished at great cost by the Emperor Hadrian. It was begun by Agaptus, for Pisistratus, in 450 B. C., and advanced by Antiochus Epiphanes.

The ancients painted statues and sculptures with showy colours.

Egyptian architecture originates in forms of the ancient caves. Chinese from the tent. Grecian from the wooden cabin, and the Gothic from bowers. Architects did not violate the forms which accorded with popular prejudices.

The Doric order is known by its triglyphs, the Ionic by its volutes, and the Corinthian by its acanthus.

The Greek orders are Doric, Ionic, and Corinthian. The Romans added Tuscan and Composite.

The Ionic had its fluted columns, 8 or 9 diameters in heighth. The capital consisted of volutes or scrolls, like horns of the ram.

The Corinthian had columns 10 diameters in heighth. The capital is acanthus-leaves, resembling Egyptian. All the parts are much decorated.

The Tuscan resembles the Doric, with columns of 8 diameters.

The Composite was formed out of the Corinthian and Ionic.

The mixed Greco-Gothic style originated in making new structures out of the materials of old ones.

The Saxon style is distinguished by its semi-circular arches.

The Moorish or Arabesque style is distinguished for its ornaments and splendour. Granada, Seville, and Cordova, have fine specimens.

The Gothic or Cathedral style originated in the middle ages. Its characters are pointed arches, spires or pinnacles, and clustered pillars.

The front of a building is called a façade, and usually consists of a portico with pedestals, columns, and the entablature at the top of the columns.

A diameter is the measure of a column at its base. A module is half, and a minute the 60th part.

In a dome the strength is greater than in the arch, owing to the lateral support all round. The dome of the Pantheon at Rome has stood above 2000 years. The abutments, however, must be strong, and the dome spring from them, not from walls.

The arch is found in ancient Egyptian buildings, though not adopted by the Greeks, and it exists in Cloaco Maxima at Rome. The strongest arch permits a straight line from the key-stone through every voussoir on each side to the piers.

Caryatides, to support entablatures, were figures of Carian women, taken prisoners in the city of Caria, by the Athenians. Men are called Atlantides.

Columns, or pillars of support for strength, ought to be the frustrum of a cone like the Egyptian, but owing to the continuation of the material of the column, equal strength is gained by a gradual swelling in the middle. In the Parthenon, the entasis is greatest at a third of the heighth.

Building in Pise, is when a plastic material is rammed into moulds.

The strength of lintels is as the square of their depth.

The arch is stronger than the lintel, and will only yield to a force which crushes its own material.

Arches are semi-circular, elliptical, or in the form of a suspended chain, inverted and called cutinary. These last, however, resemble a circle for 120°, and rise from the abutments at 30°.

The acute, or lancet arch of the gothic style, is described by two centres outside the arch.

The Moorish arch is described by centres above the base line.

Every stone, or brick, in an arch, is a wedge, whose force is directed against the abutments.

The roofs of Egyptian temples are covered with blocks of stone, laid from wall to wall. Their columns were often 10 or 12 feet in diameter. Their capitals were varied from plain stones to palm-leaves.

The Chinese build chiefly of wood, but sometimes with brick.

Parian marble and terra cotta, or baked clay, have preserved works of art, when granite or porphyry are decomposed.

Some granites have preserved works of art above 3000 years.

Bricks, united with cement, will bear a pressure from 23 to 30 tons. Portland stone, 173 tons; granites, except Aberdeen, yield to their own weight when above 200 feet high.

A new order is the Philosopher's Stone of Architects, to discover which, hundreds have vainly wasted their lives. It would seem as though the limits of symmetry were bounded in number like the regular solids, and that some Euclid or Diophantus aided the first architects in fixing the limits.

The senses suffer a singular illusion from the symmetrical arrangements of common wood, stone, &c. &c. in architectural structures. All the wood and stone, howsoever ornamented and carved, have been unshapen in trees or quarries; and all the colours, gilding, &c. &c. have been derived from the rudest materials. But combined by rule, they create a sentiment which often governs and misleads the mind, and without any reason, except in the imagination, a costly temple inspires more homage of the mind than a barn or a mud cottage. It is an illusion of the senses, of which statecraft and priestcraft take very unfair advantages, and they add to the effect by loftiness and expanse, so as to exalt the senses beyond their usual powers. The Egyptians, &c. made the most of this mental mistake in temples, &c. of which vastness was the chief feature, and the builders of cathedrals in the middle ages took a lesson from them.

In domestic architecture, a proportioned room is a breadth and a half long. South-east is the best aspect of an English house, and South or East the next best.

Rome has catacombs of vast extent; and Paris and Syracuse have others; but no mummies.

Among the Romans and the eastern nations, bathing was a constant and costly luxury, and warm-bathing generally prevailed; while, to indulge in it, every refinement of architecture and ornament was exerted. The public baths had five or six apartments for dressing and undressing, and they were called Thermæ. In Rome, there were 856 public baths; single ones of which could accommodate 1800 persons at once.

The aqueducts which brought water were the Appian, the old and new Aneo, the Martia, the Virginia, and Claudia. The old Aneo was 43 miles. Martia was 41 miles, of which 38 miles was on 7000 arcades, 70 feet high. Julia and Tepula were two upper channels, or higher levels. Claudia was 47 miles, and 100 feet high, so as to furnish the hills. They brought 40 millions of cubic feet daily. Three remain, and supply 5 millions of cubic feet. All Roman cities were similarly supplied. The aqueducts at Metz, Nismes, and Segovia, were most wonderful works.

Rome was supplied with water by 13,594 pipes from the aqueducts.

Aqueducts were invented by Appius Claudius, about 300 B. C. But they are now deemed useless, because water always rises to its own level.

Twelve great roads diverged from ancient Rome, and spread in straight lines all over the empire, there being 12 branches near the city, and 18 in Italy.

Our greatest aqueduct is for the Ellesmere Canal, across the Dee, and the Vale of Llangollen. It is of cast-iron, 1000 feet long, on 19 arches. There is another at Chirk, of 600 feet. That of the Bridgewater Canal is 600 feet long, and 36 wide, over the Irwell. The modern railways have produced viaducts of astonishing size.

Amphitheatres were vast erections in the Roman empire, to amuse, or rather brutalize the people, and qualify them for military life, by the exhibition of murderous contests between gladiators and wild beasts. They were of an elliptical form, and adapted for thousands of spectators, to whom carnage was made a pastime. They were invented by Julius Cæsar and Curio. Augustus caused them to be erected every where. In the reign of Tiberius one fell at Fidenæ, by which 50,000 persons were killed or wounded. Vespasian built the first of stone, the vast Coliseum, for 100 000 spectators. Its longest diameter is 615·5 feet, and the other 510, covering 5¼ acres, and being 120 feet high. It was imitated at Capua, Verona, Nismes, Autun, and Pola; while at Italica, Alba, Otriculi, Puzzuoli, Pæstum, Syracuse, Corinth, Arles, Caerleon, and other places, were smaller ones.

On the triumph of Trajan over the Dacians, 11,000 animals were killed in those at Rome; and 10,000 gladiators fought during 123 days. The gladiators at first were malefactors, who fought for victory and life; or captives and slaves, who were made to fight for freedom; but soon many lived by it as a profession, and even ladies became gladiators. They continued with modifications for above 500 years. Tilts and tournaments were the last remains of them.

The roofs of houses, among the ancients and eastern nations, are flat; and they often sleep upon them, and have gardens upon them. The Greeks gave the roof a small elevation in the middle; the Romans increased it to a fifth of the span. The Germans, and others, make the roof an equilateral triangle.

All the chambers in the houses at Pompeii, and the best, (those entirely painted,) received light only by the doors. Neither the rooms nor houses have any kind of symmetry; even a mosaic pavement has been seen to descend towards the door. The only house with two stories, is at Pompeii, and the stories consist of arches over each other.

Winckelman, quoting the comedies of Plautus and Terence, observes, that Grecian doors opened outwards; so that a person leaving the house, knocked first within, lest he should open the door in the face of a passenger. Hinges were not then in use; and at Rome, Pompeii, and Herculaneum, doors, even of marble, have at top and bottom pivots, which turn in sockets.

Forums were places originally destined to negociation, either of merchants or others, whose dealings took place in the open air. They were generally surrounded by a colonnade, over which was sometimes a second, for the convenience of those who wished to view the shows, for the forum was also the scene of the gladiatorial combats.

Basilicæ were subsequently added, for the protection of litigants, and decision of causes under shelter. No city, however small, was without its Forum. It was a market-place for all kinds of goods, whether of rustics or citizens. Under its porticoes were exercised all sorts of trades, liberal, servile, or sordid; and within them were arranged bankers' shops and coffee-houses.

In the *Forum* was also the senate-house, the curia for the assemblies of Augustals (similar to our common-council) and priests for cognizance of sacred matters, the Comitia for assemblies of the people, the Ærarium, or Treasury, Record-office, and public granaries.—*Fosbrooke.*

The Alhambra, at Granada, is a famous palace of the Saracens, of unparalleled splendour and curiosity, built in 1360.

Buono embellished Venice, &c. about 1150.

The principal English architects have been William of Wickham, Inigo Jones, Wren, Vanburgh, Gibbs, Dance, Gandon, Chambers, Wyatville, and Nash.

The Sea Wall, at Brighton, is 2 miles long, and 30 or 40 feet high. It is 26 feet thick at the base, and 4½ at the top. Its material is a compost which hardens by time, so as to be a monument of skill and labour for ages. Even with its top is the finest promenade in the world. It cost 100,000*l.*

The Cathedral of Rheims, the earliest example of Gothic, was built in 840, by Romualdus, and rebuilt in 1280. Sugger built St. Denis, in 1150.

Chimneys are not alluded to by Vitruvius, nor by any ancient writer; and none are found in the buildings of Herculaneum. A hole in the roof let out the smoke, and in other cases frankincense and perfumes were mixed with the smoke and fumes of fuel. The first records of them are in Italy.

Kits-coty-house, as it is called, in Kent, consists of three upright stones, eight or nine feet high, surmounted by a very large slab. Similar structures are common all over Europe, and bear the name of *Cromlechs.*

The elevation of modern buildings is as follows:—

	feet.
Highest pyramid in Egypt	479
Second ditto	428
Cathedral at Antwerp	472
Cathedral at Strasburg	466
Tower of Utrecht	464
Steeple of St. Stephen, at Vienna	460
Steeple of St. Martin, at Landshut	450
St. Peter's, at Rome	434
Steeple of St. Michael, at Hambro'	430
Steeple of St. Peter, at Hambro'	395
St Paul's Cathedral, London	404
Cathedral of Ulm	260
Cathedral of Milan	360
Tower of the Asinelli, at Bologna	354
Dome of the Invalids, at Paris	347
Cathedral of Magdebourg	337
Salisbury Spire	410
Canterbury Tower	235
St. Maria, Florence	386
Monument, London	202
Trajan's Column	132

The great pyramid of Egypt is 6½ feet higher than the church at Antwerp, and 13 than the Tower of Strasburg. It is to St. Peter's as 146 to 132; and to St. Paul's as 146 to 110; to Snowdon, as 1 to 7½; to Mont-Blanc, as 1 to 33; to Chimborazo, as 1 to 45; and, to the Himalayas, as 1 to 53½.

Cromlechs and Kist-vaens are tombstones, rude counterparts of the square tombs seen in every church-yard; tributes of affection to the memory of the dead, set up before the invention of church-yards. Tumuli, or earth hills, raised where stones were scarce, have counterparts in the modern graves of circumscribed burying-grounds.

A Cromlech, near Carlow, is a slab 23 feet by 18, and 4½ thick, on 3 uprights above 5 feet high.

New Grange, near Drogheda, is a very remarkable Irish or Phœnician antiquity. It is a cavern with a mount and a cupola, surrounded by a circle of stones.

Nearly 70 round towers, with cromlechs, or *croom lecheir*, &c. exist in various parts of Ireland, from 30 to 135 feet high.

Barrow is the name of those circular mounds found in Britain and other countries, to record a burial on the spot. Their size is supposed to be proportioned to the rank and means of the party. The kings of Egypt built pyramids. The largest in England is that of Silbury-hill, near Marlborough. In Scotland, they are called Cairns. The Greeks made large barrows; but the largest, next to the pyramids, are those of the Kings of Lydia. One of these is three-quarters of a mile round. Even the savages in America erect similar monuments, and some of great size. In Scotland and Wales they are often made of stones. Those which have been opened in England contained skeletons, urns, and warlike implements, with remains of Cambrian ornaments, such as beads, buckles, and brooches, in amber, wood, and gold.

Silbury-hill covers 5 acres; its sides are 316 feet, and its perpendicular heighth 170.

Caer-leon, or Caer-lion, near Newport, in Monmouthshire, was, beyond question, a British city of considerable size and splendour. It is now reduced to a small town; but the vicinity is covered with foundations, and the plough turns up numerous antiquities of remote ages.

Stone-henge, in Wiltshire, is our chief existing monument of ante-Roman antiquity. There can be no doubt but it was a Temple of Baal. It is circular, open at the top, and consists of *exactly* such dispositions of upright and cross stones, as at this day compose the great ruins in Egypt. The heads and horns of oxen and other animals, found buried in the spot, prove that the rites peculiar to solar worship were actually practised. The present Stone-henge was repaired by Ambrosius, about 460.

Abury, near Marlborough, consisted of 650 stones, the principal circle of 100, and two interior double circles of 30 and 12 each. The whole area of the circle is above 28 acres. The avenues were a mile each, with 100 stones on each side of each.

Carnac, near Quiberon, and Auray in Brittany, the country of the Veneti, is 8 miles long, with 11 rows of parallel stones, but not in continuity, and 200 to 350 feet wide. Many of the stones are 15 to 17 feet high, and 4 by 6. Others but 3 feet or 9 feet, in all above 10,000 stones! The rocks whence the stones are quarried are always near them, and the local origin of the stones is palpable, but the whole plan is mutilated for building purposes, and 1500 or 2000 stones removed. There are cromlechs, whose table-stones are 13, 15, and 18 feet. It has a mount, like Silbury-hill at Abury. There were two obelisks of single stones, one 63 feet long by 14 diameter, weighing 260 tons. The antiquaries consider it a Dracontium Ophite, or Serpent Temple. We consider it a monument which Sesostris or Hercules set up at the end of the continent.

Adrian's Wall, from the Forth to the Clyde, was built in 120, of turf. Antoninus, another, in 140; and Severus, one of stone, in 208. It had a ditch to the north 40 feet wide, and 20 deep, and the wall was 20 feet high and 24 thick. It extended 36½ miles, and joined 21 Roman forts. The Picts' Wall extends from Newcastle to Bowness, on the Solway Firth. It was originally of turf; but, in 416, was rebuilt of stone.

Diodorus Siculus speaks of the houses of the Britons as built of wood, and the walls of stakes and wattling, like hurdles, and thatched with reeds or straw, and wattled chimnies still occur in Wales. Afterwards, some set up strong stakes in the banks of earth, as well as large stones, rudely laid on each other without mortar. Strabo says, that the fashion was round, with a high-pointed covering at top; and Cæsar, that they resembled the Gaulish houses, and were only lighted by the door. The representations of them on the Antonine column, are either as cylinders, with an arched lofty entrance, single or double, or as exact facsimiles of great tea-canisters in grocers' shops, the orifice, where the lid shuts, being (according to Henry) for emission of smoke. Strutt says, that they were built at some distance from each other, not in streets, and generally on the banks of a river for water, or in woods, &c. where forage might be found. The prince chose the most convenient, and his followers erected theirs around, as well as stalls for the cattle; a ditch and mound of earth, or rampart, surrounded them.

Sammes, speaking of the first church of Glastonbury, says thus: "the walls of the church were made of twigs, winded and twisted together, after the ancient costume, in which kings' palaces were used to be built. Castles themselves, in those daies, were framed of the same materials, and weaved together."

In the beginning of the 13th century, the Gothic style seems to have been completely established. In this early style, the arches differed very much, but were usually sharply pointed; the windows long, narrow, and lancet-shaped, and frequently decorated in the inside, and sometimes on the outside also, with slender shafts, frequently with fasciæ round them, and the capitals with foliage.—*Lysons.*

York Minster, says Elmes, is the Parthenon of Gothic Architecture; Westminster Abbey, the Temple of Theseus; and Henry VII.'s Chapel, the monument of Lysicrates.

Canterbury Cathedral is 514 feet long, 80 feet high, and 154 feet broad; the choir is 180 feet by 40. It nearly adjoins the ruins of St. Austin's Abbey, part of which is now a brewhouse: and at the distance of half a mile is St. Martin's Church, the first for Christian service in Britain.

Walbrook Church is famous all over Europe, and is justly reputed the masterpiece of Sir Christopher Wren.

The whole coast of the Syrtes and Cyrenica is a mine of antiquities, inscriptions, and works of Grecian art.—*Dellacilla.*

The roads, causeways, and public works of the Incas in Peru, are, for vastness, paralleled only by the great wall of China, or by the straight military roads of the Romans, which united Rome and the whole empire by the shortest distance.

The ruins of an ancient city, called *Palenque*, of great extent and high finish, have been discovered by Gen. Galindo, in a thick forest, near Peten, in the vicinity of the *Usumasinta;* and the neighbouring country is also filled with architectural works. These and other remains in North America, and the city of Copan, also, lately discovered by the General in Guatimala, seem to prove revolutions of which we have no accounts.

The Pyramid of Cholula stands on a base 480 yards each way, and was 180 feet high, containing 7 million yards of earth. There are also Pyramids, Techotihuachan, at other places, and at least a score of large cities in desolation have been discovered since the

Spanish intrusion in remote places, all indicative of once flourishing, but now lost people. They are called Toltec and Astec, and the nation, according to Indian tradition, was destroyed by famine and pestilence. Curious specimens of their sculpture have lately been recovered on the Panuco. They divided the year into 18 months of 20 days, with 5 days, and added 13 and 12 days every 52 years, so as to produce great accuracy. Their movements are traced from Darien over an extent of 2100 miles northward. Lord Kingsborough has published a splendid work of drawings from all these monuments, and, really, they vie with remains of Egypt itself. These are referred to our era, but may have been far more ancient; and there must have been some physical cause for the total extinction of such a people. Were they drowned at the last passage of the Perihelion, or were they destroyed by some atmospheric change?

The wretched people who inhabit the coasts of the Frozen Ocean are called Samoiedes or Cannibals, but ruins of ancient towns have been found in their country, built by some more ancient people.

Napoleon's roads over the Alps are—that over Cenis, 30 miles long and 18 yards broad; that over Semplon, 36 miles long and 25 yards broad; partly through galleries hewn in the rocks, one 683 feet; that over Genevre, 6000 feet high; that from Nice to Monaco; and that over St. Gothard, 8264 feet high. Altogether, they are the most gigantic efforts of human labour since the Pyramids of Egypt, and created the murderous envy of puny legitimates of this age.

MODERN CAPITALS OF NATIONS,

Chiefly with a View to Architecture.

There are 56 cities in the world, which contain from 100,000 to 200,000 inhabitants; 22 from 200,000 to 500,000; and 12 which contain above 500,000, two of which are London and Paris, and ten are in Eastern Asia.

The Promenades of the European capitals are, *Hyde Park* at London; the *Retiro* at Madrid; the *Corso* at Rome; the *Champs Elysées* at Paris; the *Prado* at Vienna; the *Linden* at Berlin; and the *Park* at Bruxelles.

AMSTERDAM, the Capital of the province and kingdom of Holland, is situated at the point of confluence of the river Amstel with the Y, an arm of the Zuyder Zee. It was a considerable town in the 14th century; but it was not till the 16th century, when the persecutions of the Spaniards in Belgium proved fatal to the trade and navigation of Antwerp and the southern provinces, that Amsterdam attained to the distinction enjoyed, till about the middle of the last century, of being the first commercial city of Europe. When most prosperous, Amsterdam is supposed to have contained about 240,000 inhabitants. Being built in a marsh, the foundations of the city are laid on piles; and a house costs as much below as above ground. The three principal streets are parallel to each other, and are not easily to be matched for length, breadth, and the magnificence of the houses; many of which, though antique, are splendid, and are kept in the best repair. The city is intersected by an immense number of canals, communicating by draw-bridges, and having sluices for the purpose of regulating the level of the water: these canals are, for the most part, bordered by fine trees. The expence incurred in keeping the sluices in order, and in clearing the canals and port of mud, are very heavy. The stadthouse, now the royal palace, is the finest building in the city; and is one of the noblest any where to be met with. About 13,000 piles are said to have been employed in forming its foundation. The harbour is inconvenient, large ships being obliged to lighten before they can pass the mouth of the Y, and the navigation of the Zuyder Zee is also difficult. The trade of Amsterdam has increased considerably, and about 2200 ships now annually clear out for Foreign countries. The town is supplied with fresh water, conveyed in carts from the Vecht, about 5 or 6 miles distant. There is a national museum of pictures, which contains many fine specimens of the Dutch school. The various prisons and houses of correction and industry at Amsterdam, are said to be managed on more approved principles than similar institutions in most parts of Europe. The police is excellent; crimes rare; and no beggars are to be seen in the streets. The inhabitants seem vigorous and healthy; but the mortality is greater than in most European cities.

ASHANTEE, but 150 miles from the Gold Coast, is a large city, with a magnificent royal palace and splendid court, far advanced in civilization. Bowditch says, he never saw soil so rich, or vegetation so luxuriant.

The Emperor of Borneo resides at BARVAR-MASSIN, a city built of bamboos, of which material the dwellings are of an immense size.

BERLIN, the Capital of Brandenburg, and of the Prussian monarchy, is one of the finest cities in Europe; being the recent and studied creation of an absolute monarch, it has been formed upon a regular plan, and on a liberal scale of expenditure. The Brandenburg Gate is considered the most simple and majestic portal in Europe. This matchless gate forms the entrance into the Linden-strasse, which, as a street, is perhaps, also, without a rival. It is divided by double rows of linden, or lime-trees, into fine alleys, which afford delightful walks, and along which are ranged edifices of the most majestic and classical character. Among these are chiefly remarked, the palace situated on the Place de Gendarmes, seen along a line of lofty façade, ornamented with porticoes,

statues, and every variety of sculptural decoration; the Italian opera-house, the churches, and the theatre, built with the intention of eclipsing all the other productions of Prussian architectural taste. The design is uniformly that of an Ionic portico, on a very simple front. The other streets and squares are broad, spacious, and regular. The Spree, which divides Berlin, has the appearance of a broad ditch, navigated by flat-bottomed boats. On the opposite side is the old town, a scene of traffic, with little pretentions to beauty. Berlin carries on various manufactures of woollen, linen, and particularly silk, with a royal manufactory of porcelain. The trade of Berlin is also extensive, as it communicates by the Spree and its canals, both with the Elbe and the Oder. A fine university has been founded, which, in 1834, contained 2100 students, and ranks as one of the first in Germany. This Capital has also royal academies of science and the fine arts; a splendid public library; cabinets of natural history; a botanic garden containing 12,000 exotic plants; and a fine picture gallery.

BEJAPOUR, a city in the part of India called the Deccan, is one of the largest in Hindoostan. It formerly contained nearly a million of houses, and 1600 mosques and temples. The great mosque of Adilshah, built about 1660, is about 500 feet long, and 240 broad; and the mausoleum of the Shah is 153 feet square, and 100 feet high. There is also an older mosque, built in 1620, 390 feet long, and 160 broad, which employed 6500 workmen 37 years. Bejapour abounds in magnificent structures. In its forts are three pieces of cannon, from 14 to 30 feet long.

BERNE, generally considered the Capital of Switzerland, is situated in the centre of the plain, in a commanding position above the Aar, which nearly encircles it on all sides. Fine and ancient woods reach almost to the gates of the city, bearing a noble and even majestic aspect. It suggests the idea of a Roman town, yet its handsomest houses and most sumptuous edifices date all since 1760. The Gothic cathedral, of the 15th century, the church of St. Esprit, the mint, and the hospital, are among its principal buildings; while the private mansions are handsome, and solid rather than showy. But the magnificence of Berne is mainly derived from its wide and lofty terraces, commanding the most superb views over the plain beneath, and the entire range of the Alps; from the spacious fountains by which its streets are supplied and refreshed, and from the fine avenues of trees which penetrate through the city. Berne has a public library, to which some valuable collections are attached.

BOKHARA, the Capital of Tartary. According to Elphinstone and the late Russian mission, the city of Bokhara contains 70,000 or 80,000 inhabitants; but Burns estimates them at 150,000. There are a number of mosques, and *madresses* or colleges, handsomely built of stone. Bokhara is a great seat of Mahometan learning, such as it is, and the government encourages it; the city containing 366 madresses many attended by 70 or 80 students. To every madresse there is a lecturer, and these with the students are supported by funds consisting chiefly of the rent of lands or houses, appropriated to that purpose by Mahometan zeal and charity.

BOMBAY, this western capital of British India, is situated on a small island, connected by an artificial causeway with the larger one of Salsette. It commands a beautiful view over a bay diversified with rocky islets, and crowned by a background of lofty and picturesque hills. In 1661, Bombay was ceded to Charles II. as part of Queen Catherine's portion; two or three years after, a settlement was established, and in 1686, the chief seat of English trade was transferred thither from Surat. Since that time Bombay, notwithstanding considerable vicissitudes, has continued on the whole in a state of constant increase, and has become the great emporium of western India, with a population of 220,000. A literary society has been established, chiefly with a view of exploring the learning, history, and antiquities of India.

BRUSSELS is the Capital of Belgium, and, considered as such, it is small, yet it is one of the gayest and most elegant cities of Europe. Its situation is fine, in a valley watered by the Senne, and the canal to Antwerp. The Allée Verté, consisting of 3 rows of trees bordering the canal, makes a beautiful approach. The market-place and the park are the two great ornaments of Brussels. The former is of great extent, and surrounded by the Town Hall, one of the most elegant Gothic structures in Europe, adorned with a tower 348 feet high, and by the old halls of the different corporations. The park forms an extensive range of pleasure-ground, interspersed with rows of lofty trees, and pleasing lawns, ornamented with fountains and statues; and it is surrounded by all the most spacious and sumptuous edifices. The church and chapel of St. Gudule are also distinguished for the elegance of their ornaments. Brussels has an academy of painting, attended by 400 or 500 students; and in the palace there is a valuable collection of paintings.

The great cities of the Netherlands, built or improved by the Spanish Government, abound in town-halls, religious edifices, &c. of unparalleled magnificence. Brussels, Louvain, Antwerp, Ghent, Bruges, Tournay, Ypres, Lisle, &c., are remarkable instances of splendid and gigantic structures, in towns of antiquated structure.

BUENOS AYRES is situated on the southern bank of the Rio de la Plata, about 200 miles above its mouth; and, being raised about 20 feet above the river, and present-

ing the spires of numerous churches and convents, it makes a fine appearance. The houses are new, built of brick, white-washed, and with flat roofs, over which may be taken a pleasant and even extensive walk. The windows are protected by iron bars, forming a complete fortification; which enabled the town to make a formidable and effectual resistance to the British army, absurdly marched into it by Whitlock. Along the beach there is a street which resembles Wapping, being crowded with grog shops. The cathedral, though built of brick, is a very handsome structure, as are several of the other churches and monasteries. The fortress, in which the viceroy formerly resided, is situated near the river. The town, on the whole, is handsome, especially the houses surrounding the great square. The environs on the land-side have a very monotonous aspect. The population is estimated at 70,000.

CAIRO, the Great, or Grand Cairo, attracts the attention of the traveller sailing up the Nile, and he gazes with wonder on the numerous minarets which distinguish this capital of Egypt. The new city, which has alone risen to the rank of a capital, was founded, in 973, by the first of the Fatimite caliphs. Saladin surrounded it with strong walls and magnificent gates; and it soon eclipsed Alexandria. The streets are narrow and winding; the principal one, which traverses the whole area of the city, would be considered in Europe as a mere lane. The houses are two or three stories high, but almost all their light is derived from interior courts, and they present to the street only a mass of dead walls, like prisons. There are, however, several extensive open squares, round which are built the houses of the principal persons. Into these, when the Nile rises, the water is conveyed by a canal called the Kalisch, which converts them into lakes. The chief ornaments of Cairo consists in its gates, and in its mosques, of which that of Hassan displays all the splendour of Saracenic architecture. Many of the baths have their interior richly ornamented. The tombs of the Mamelukes, built of white marble and with painted or gilded domes, are very beautiful. The Pacha resides in the citadel, where he has magnificent apartments.

Cairo is 7½ miles in circuit, and, according to Volney, contains more than 250,000 inhabitants, and to Balbi 330,000. The police is maintained with great strictness, each street being shut in at night with gates, and guarded. Notwithstanding the gloomy exterior of the houses, the interior of these mansions possess great magnificence.

Cairo is the greatest thoroughfare of any city in the world. It forms the link between the Asiatic and African continents. With the interior of Africa, in particular, a vast trade is carried on. The amusements of Cairo are generally of a very humble nature; tumbling, rope-dancing, and juggling, are publicly performed in the few open spaces which the city affords. For the amusement of the rich, there are improvisatory poets, both male and female, who display talent.

Grand Cairo stands near the eastern side of the Nile, and adjoining it is the rocky mountain Mokaddem. A mile westward, on the Nile, is Boulac, its port; and a mile northward is Fostatt, once the capital. With reference to the various nations and religions, the splendour and poverty of its inhabitants, Cairo is the strangest assemblage in the world. Mahomedans, Christians, Jews, and Idolaters, tawny, black, brown, and white, with camels, horses, asses, and wild dogs, fill its streets, besides abundance of filth. The citadel, near Mokaddem, is three miles round, and contains what is called Joseph's Well, cut 276 feet through the rock, and Joseph's Palace, from *Yussuf*, the name of Saladin.

After restoring the palace of Saladin on Mokattam, Ali Pacha has built himself a new palace, which contains a pavilion 250 feet long by 200 broad.

CALCUTTA, on the Hoogly branch of the Ganges, and the capital of India, from a few straggling cottages in a wooded marsh, has been raised since 1696. The English were then allowed by Aurengzebe to establish a factory, and in the following year to secure it by a fort. In 1757, it had not above seventy English houses, when it was taken and destroyed by Surarjah Dowlah. Lord Clive, having become master of Bengal, made Calcutta the capital, and founded a fort, which has cost about £2 000,000, and is now very strong. Calcutta is supposed to contain 500,000 inhabitants; while, within a radius of twenty miles, there are upwards of 2,000,000. The English town, or suburb, called Chouringee, consists of 4300 houses. Though built only of brick, it is elegant and even superb; the houses are handsome, covered with chunam, each being detached and surrounded by a wall. Strangers ascending the river are particularly struck by the number of elegant villas with which all the environs are studded. The Black Town, comprising the greater part of Calcutta, consists, as in other parts of India, of miserable cottages of mud and bamboo. The government-house is a very splendid and costly structure; and considerable state is maintained, in rivalry of Asiatic courts. A college was founded by the Marquess Wellesley, which boasts many illustrious members, but has of late been much reduced. Barrackpore, 16 miles from Calcutta, is the magnificent seat and park of the governor-general. Nearly opposite, is the splendid Danish settlement of Serampore.

CHRISTIANA, with a population of 21,000, now ranks as the Capital of the whole kingdom of Norway. It is situated at the head of a long interior bay or ford, and in a situation which Van Buch considers as altogether wonderful. The bay, its islands, the crowds of sails spread among them, with the view of majestic hills rising over hills in the distance, appeared to him equalled only on

the lake of Geneva, which, however, has not the vessels and islands. Christiana is chiefly supported by trade in deals; and those cut in its saw mills are considered, by connoisseurs in this article, to be superior to all others. Some of its merchants maintain the state of princes, and are considered equal, in wealth and liberal views, to any in Europe. The buildings are regular, and mostly of stone; and, since the union with Sweden, it has received a university with two professors.

CONSTANTINOPLE occupies, perhaps, the most commanding and important site of any city in the world. Mistress of the long chain of straits connecting the two great seas which separate Europe from Asia, it forms the link between those continents Hence, even while Thrace was steeped in barbarism, Byzantium flourished as a great commercial republic, until the period when Constantine raised it to higher importance, by giving to it his name, and making it the capital of his empire. Even after the separation of the West, it continued the metropolis of the East, and rose in importance during the encroachments on its territory by the invading tribes. As the world was overwhelmed with the prodigious inundation of the barbarians, Constantinople became the refuge of all that remained of ancient science and civilization. Taken in 1453 by Mahomet II. it became the capital of Moslem ignorance; yet it still continues one of the greatest cities in Europe, ranking next to London and Paris. The population, in the absence of any kind of census, can be little more than conjectured. Eton gives the lowest estimate, which is 300.000; others 800,000.

The situation of Constantinople is as beautiful and superb as it is commodious. The port is spacious and admirable. On the side of Europe and Asia, rich plains spread before the eye, bounded by the snowy tops of Hemus and Olympus. The city itself, rising on seven hills, along the shore of the Bosphorus, embosomed in groves, from amid which, numerous gilded domes ascend to a lofty height, presents a most magnificent spectacle. But the moment the interior is entered, all the magic scene disappears. The streets are narrow, winding, ill-paved, and crowded; the houses low and gloomy; and the hills, which appeared majestic in the view, causing steep ascents and descents, prove excessively inconvenient. But the most fatal circumstance in the structure of Constantinople is, that the houses of rich and poor are alike entirely composed of wood, while chimneys are not generally used, but their place supplied by vessels of brass or earth put under the feet. These circumstances, joined to the usual improvidence of the Mahometans, cause tremendous conflagrations. It is, therefore, reckoned that Constantinople rises entire from its ashes in the course of every 15 years; but no advantage is ever taken of the circumstance to improve its aspect. The fallen streets are immediately re-constructed, with all their imperfections, and the houses re-built of the same fragile materials. This city contains, however, some structures that are very magnificent. Among them stands foremost the mosque of St. Sophia, accounted the finest in the world, first built as a church by Justinian, and converted by the conquering Turks to its present use. The mosques of Sultan Achmet and Suleyman are equally vast and splendid. The numerous minarets are, in general, airy and elegant, and add greatly to the beauty of the city.

The Seraglio, at Constantinople, is on the eastern point. The area is 150 acres, inclosed with high walls. The entrance from the west is called the Sublime Porte, a name frequently given to the whole government. The second gate is called the Gate of Happiness, and in its splendid buildings are lodged from 5 to 600 females, guarded by eunuchs. There is also an old seraglio in the centre of the city, where are kept the wives and concubines of former sultans.

The Thracian Bosphorus, or Strait of Constantinople, is 20 miles long, 1½ broad, and 240 feet deep, with a current E. to W. into the Propontis or Marmora of 3 miles an hour, and thence by the Darnanelles into the Archipelago. Thirty-four towns, besides palaces and villas, line the whole length. The Turks call the city *Stambol*, and Europe *Roumelia*. Scutari is on the Asiatic side, opposite the Golden Horn or Crescent Harbour, and Pera is the extreme European suburb.

Among ancient reliques are the 100 pillars in St. Sophia, from the temples of Diana, &c. The marble pillars of Jeni Jami from Troy. The sarcophagus of Constantine, 11 feet by 6½ and 8½, &c. &c.

Ö in German, &c., sounds as U, and Török is *Turuk* or *Turk*. *Islam* is derived from *Salaam*, obeisance. *Moslim*, is a follower, and its plural, *Mooslimeen*, is our Mussulman.

COPENHAGEN—(In Danish, Kiobenhafn, or the "merchant port)" is the Capital of Denmark, and situated on the east coast of Zealand. Its walls enclose a circuit of 5 miles, a great part of which, however, is covered with open spaces, and with the harbour and docks. The houses, with a few exceptions, are built of brick plastered over, and painted in different colours. They are lofty, and contain many families in each. The city is divided into three parts: the old town, which contains the greater part of the population; the new town, in which are all the finest edifices; and the port, or Christian's haven. In the midst of the principal square is the bronze statue of Frederick V., weighing 45.000 lbs., and which cost 400,000 rix-dollars. This square, with the adjoining one called the King's Mark Place, surrounded by the palace of Charlottenburg, the theatre, the principal hotel, and other stately buildings, forms the handsomest part of Copenhagen. The cathedral was destroyed during the bombardment by the English, and is left in ruins; but the Frue Kirke

is an elegant Grecian edifice, 215 by 180 feet, with a Doric portico, for which Thorwaldsen has executed statues of the Apostles and Evangelists. The palace of Rosenburg was built from a design of Inigo Jones, and contains an extraordinary display of jewels, precious stones, and porcelain. The collections in science and art are equal to those of the greatest capitals. The king has a library of 250,000 volumes, with numerous manuscripts, illustrative of the history and literature of the North, as well as those brought by Niebuhr from the East; an extensive museum of northern antiquities; a gallery of pictures, comprising some fine specimens of the greatest masters, and a numerous collection of engravings. The arsenal is said to equal that of Venice in beauty, and to surpass it in extent. The mint throws off 200 pieces in a minute.

DER'AYAH is the Capital of the Wahabis, in the valley of Beni Hanifah.

DRESDEN.—Though not one of the largest, is generally reckoned the most elegant of the German cities: it has been called the Florence of Germany. It is almost unrivalled in situation, the country around presenting a mixture of romantic natural scenery, with the richest possible cultivation. The banks of the Elbe are on one side abrupt, rocky, woody, picturesque; on the other, they swell into graceful and verdant eminences. The streets of the old town are somewhat narrow, but bordered by many lofty palaces of the Saxon nobles, built in a simple and austere style of architecture. The royal palace is of great extent, and contains many elegant features; but these are so various and scattered, as to produce nothing striking as a whole. The new town, on the opposite bank, is built in a lighter, and more regular style, and has one very fine street. The stone bridge of 11 arches, over the Elbe, is the finest structure of the kind in Germany. Dresden is illustrious for its collections in literature and the arts. The royal library is one of the first in Germany, and the picture-gallery has no rival on this side of the Alps. There is also an immense and valuable collection of prints, of casts, and of antiquities.

DUBLIN presents an aspect scarcely indicative of the ills under which the nation groans. It disputes with Edinburgh and Bath the reputation of being the most beautiful city in the empire. If the brick of which the houses are built impair the effect of the general range of its streets and squares, its public buildings, composed of stone, surpass in grandeur and taste any of its rivals. All its splendour has arisen within the last 60 or 70 years. The numerous streets and squares formed during that period have been built on a regular plan, and contain many superb mansions, which once belonged to the principal nobles. The squares are particularly admired; that of St. Stephen's Green is nearly 7 furlongs in circuit; and even the want of regularity, in the form and size of the fine houses that surround it, heightens the picturesque effect. Merrion Square, which contains the splendid mansion of Leinster House; Rutland Square, in the interior of which are the gardens of the Lying-in-Hospital; and Mountjoy Square, are also spacious and finely laid out. Of the streets, the finest is Sackville Street, 170 feet wide, and adorned with many splendid mansions. To the West, further up the river, is the old town, originally much inferior to the streets above described, and now bearing marks of decay. Still farther west is the tract called "the Liberty," as being out of the jurisdiction of the magistrates. It is inhabited only by the lowest orders, and exhibits scenes of filth and wretchedness not to be paralleled in any city. Dublin has been "shorn of its beams" since the Union; when the nobles and gentry, no longer called to attend parliament, transferred their town residence to London. Their Dublin mansions have been converted to humbler purposes: for example, that of the Duke of Leinster, the most splendid of all, is occupied by the Royal Dublin Society; the Powerscourt mansion is now the Stamp Office; that of the Earl of Aldborough is a school; and the house where the parliament held its sittings, has been altered for the accommodation of the National Bank.

The castle, the residence of the lord-lieutenant, is extensive; but its architectural beauty is almost confined to a modern Gothic chapel, erected from the design of Johnstone. The cathedral of St. Patrick, and Christ-Church, have a venerable aspect; but they rank only secondary, and seem even eclipsed by the modern edifice of St. George's Church. The Royal Exchange, situated almost in the highest part of the city, was built by the merchants. It forms a square of 100 feet, and its principal front has a richly-decorated portico of six Corinthian columns. The four Law Courts, situated on the north bank of the river, form one of the noblest structures in Dublin, and consist of a square of 140 feet, presenting a front of six Corinthian pillars, supporting a circular lantern and magnificent dome. The quay is ornamented by the Custom-House. The front is entirely of Portland stone, embellished with a Doric colonnade, and extends 375 feet. The Post Office, in Sackville Street, is extensive and magnificent, with a front of 223 feet, adorned with an Ionic portico; the pillars composing which are the highest in the metropolis. It is of Portland stone, while the main structure is of fine mountain granite. The inns of Court, the theatre, the Roman Catholic metropolitan chapel, and several other churches and chapels, with many of the hospitals, may be mentioned as adding to the architectural splendour of Dublin. All the usual associations for the relief of distress are supported on a liberal scale. The Incorporated Society for Charter Schools, and the Kildare Street Society for general education, have both their central boards in this city. Tri-

nity College was founded in 1593, and its students, who, 30 years ago, did not exceed 500, now amount to 1600. The Royal Dublin Society, incorporated in 1749, for the promotion of husbandry and the useful arts, have enlarged their sphere by a most extensive botanic garden; by purchasing and extending the Leckean museum of natural history; by instituting a school of drawing with models; and by appointing teachers in all these departments. The Royal Irish Academy, incorporated in 1782, have published many estimable volumes of transactions. The Dublin Institution has been formed on the model of that of London, and a city library established. The vast number of villas and villages which cover the adjacent districts, the foreground of the Dublin mountains; and the peculiarly picturesque summits of those of Wicklow in the back ground, render the situation striking and delightful.

EDINBURGH, the Capital of Scotland, is built upon 3 ridges, running from east to west, and separated from each other by deep ravines. The Old Town, which, till the last half century, formed the whole of Edinburgh, is situated on the middle ridge, extending nearly a mile of gradual descent from the castle to the palace of Holyrood. With a view to secure the protection afforded by this site, the houses are raised 6 or 7 stories, which, from the acclivity of the ground, gives to that facing the ravine a heighth of 10 or even 14 stories. From this central street there descend, on each side, *closes* or *lanes* about 6 feet broad, sloping often at an angle of 45 degrees; so that some experience is required to descend with safety. The Cowgate, a poor street inhabited by small tradesmen, extends along the bottom of the ravine, and terminates in a spacious *grass-market*, completing Old Edinburgh.

Although it contains many excellent houses, yet all the citizens of better rank have migrated to 2 towns, built on the opposite sides of the Old Town; one on the South side; the other, called the New Town, is on the North, and at present comprises the residence of the opulent and fashionable classes. Being built on a regular plan, and of the finest free-stone, it ranks, generally, as one of the most elegant towns in Britain.

The beauty of Edinburgh is greatly enhanced by its situation, being overlooked on one side by the Castle, and, on the other, by a range of bold hills, the highest of which is called Arthur's seat.

The University of Edinburgh, founded in 1581, has risen to great fame; and it has a Royal Society for physical and literary researches; antiquarian and horticultural societies; an institution for the promotion of the fine arts; and an academy for painting.

FLORENCE, which attained so great a name under the Medici, is still a delightful city. Its situation is peculiarly happy in the vale of the Arno, which forms one continued interchange of garden and grove, enclosed by hills and distant mountains. The cathedral, while St. Peter's was not constructed, ranked as the most majestic edifice in Italy. The gallery is the chief pride of Florence, both as to its structure and contents. It has 20 apartments branching off from it, in each of which, the productions of a particular school or class of art are exhibited. In ancient sculpture, this collection has, perhaps, no rival, since it contains the Venus brought from the Medici palace, the group of Niobe, the fawn, and many other master-pieces. The paintings comprise, also, some of the greatest master-pieces of Raphael, Titian, and Andrea del Sarto. There are numerous sculptures by Michael Angelo, especially the tomb of the Medici.

JEDDO, now the seat of the ruling power, and the real capital of Japan, lies at the head of a deep bay on the eastern coast of Niphon, and at the mouth of one of the few rivers which possess any considerable magnitude. It is seven miles long and five broad, and contains many splendid palaces of the great lords, all of whom must reside in it for a great part of the year. These mansions are surrounded by wide enclosed courts and extensive gardens, yet they are only one story high, the walls of clay, the partitions of paper, and adorned merely with painting, varnishing, and fine mats spread on the floor. The palace, however, though equally low, is built of freestone, and is five leagues in circumference, including a wide exterior area occupied by the spacious mansions of the princes and great lords of the court. Its grand apartment, the hall of the thousand mats, is said to be 600 feet long by 300 broad, and is brilliantly adorned by pillars of cedar, painted papers, and gilded dragons on the roof.

JERUSALEM, or EL KODS, is built on a vast plain of arid limestone, which sustains no vegetation and no animal life, except a few beasts of prey. Eastward to the Dead Sea are the sands of Arabia, so deserted, that a recent traveller, in his route of eighteen miles to the huts called Jericho, saw no human being. To the west, to Jaffa, there is no production, and only a few tribes of banditti. To the south are the deserts, extending to Egypt; and, to the north, wretchedness and sterility cover the land as far as the sea of Galilee and Lebanon. On all sides, ther are few or no trees, and, therefore, no shad from the sultry sun. The city itself is chiefl, supported by Christian and Jewish pilgrims but the streets of huts and hovels are so narrow that only two asses can pass abreast and a wheel-carriage was never seen. Th inhabitants, too, are so inert, that De-la-Martine declares he sat a whole day nea the principal gate, and saw no soul go out or enter. The Turks have some edifices, and the Greek and Romish christians others, built on, or near, spots consecrated by the Old or New Testaments. The two sects are in constant war for preference, and each claims its own sites for the events. O

course, it is a mere trade in credulity, for, in 70, Jerusalem was razed and ploughed over by Titus, and re-founded as an heathen city by Hadrian, in 140. Helena, the concubine of Constantine, about 300 then conjectured the holy sites, and built chapels or churches near them, now deemed accurate enough for reverence and *fees* to the holders, besides grants of 12 or £15,000 a year from Catholic communities.

Jerusalem, in its greatest extent, stood upon four hills. Mount Zion was the upper or principal quarter. To the east was Mount Acra, to the east and west Moriah, and to the north Bezetha; from the last, a broad and fine valley stretched towards the ancient Samaria. On the other side, the deep valleys of Jehosaphat, Hinnom, and Siloe, penetrated to the rocks which stretch thence towards the Dead Sea. These valleys are still watered by the brook Kedron and the pool of Siloam; and the rocky sides of the hills immediately bordering on them have been excavated into tombs. The inhabited part of the city has been always upon the summits and along the sides of the hills. The walls were formerly four miles in circuit, but this is now reduced to two and a half; and a part of what is commonly supposed to be Mount Zion, is now covered only with ruins. Of the remaining circuit, a great part presents little more than the remains of a city. The gloomy desolation which pervades it is described by Chateaubriand as extreme. "The houses are heavy square masses, very low, without chimneys or windows. They have flat terraces or domes on the top, and look like prisons or sepulchres. The whole would appear to the eye one uninterrupted level, did not the steeples of the churches, the minarets and mosques, and the clumps of nopals, break the uniformity of the plain. Enter the city, you will there find nothing to compensate for the dullness of its exterior. You lose yourself among narrow unpaved streets, here going up hills, then down, from the inequality of the ground, and you walk among clouds of dust or loose stones. Canvass, stretched from house to house, increases the gloom of this labyrinth; bazaars roofed over, and fraught with infection, completely exclude the light from the desolate city. A few paltry shops expose nothing but wretchedness to view, and even these are frequently shut, from apprehension of the passage of the cadi. Not a creature is to be seen in the streets, not a creature at the gates, except now and then a peasant gliding through the gloom, concealing under his garments the fruits of his labour, lest he should be robbed of his hard earnings by a rapacious soldier. The only noise heard, from time to time, is the galloping of the steed of the desert; and is the soldier who brings the head of a Bedouin, or returns from plundering fallahs.

Two splendid objects shine conspicuous, the Church of the Sepulchre and the Mosque of Omar. The former has long been the grand object of pilgrimage to the christian world. It was erected by Helena, upon a site which was supposed to include the crucifixion, the entombment, and the resurrection. It consists properly of three churches, or chapels, connected together by walls and covered passages. The first, and most extensive, is termed the Church of the Holy Sepulchre. The rock, however, in which the tomb was excavated is allowed to be almost entirely cut away, and that part which contains the sepulchre now rises above the ground in the form of a grotto covered with slabs of *verdi antico*. Close to the entrance is a block of white marble, shewn as the stone on which the angel sat, and in the interior lamps are continually burning. The two other churches consist of large apartments, one above the other below. The lowest is called the Church of the Three Crosses. The upper church is called that of Mount Calvary, where the rock again appears with holes, supposed to indicate the site of the three crosses!

Small apartments along the sides of the walls of these churches, within and without, are occupied by monks belonging to the different nations of the east and west.

A late great traveller has openly disputed, and even derided, the whole of the locality. Dr. Clarke, however, insists that there is no hill such as could be Mount Calvary, and no space in which the crucifixion could take place; that the alleged sepulchre is not cut out in the rock, but is composed of a number of detached pieces of stone cemented together; that the stone does not fit it; in short, that it ought to be without the city, and by no means in its present position. He finds a much more probable site among a number of tombs which he discovered, in Hinnom.

The most splendid edifice in Jerusalem, however, consists of the mosque erected by Omar, on the supposed site of the temple of Solomon. It is an octagon surmounted by a lantern of the same shape, and is considered superior to any structure in the Turkish empire, not excepting the Mosque of St. Sophia at Constantinople; it yields only to the matchless boast of Saracenic art, the Alhambra. The walls are externally lined with painted tiles covered with arabesques, and with verses from the Koran in letters of gold. Its numerous arcades, its capacious dome with the rich costume of eastern devotees passing and repassing, render it, even from without, one of the grandest sights which the Mahometan world has to boast of. The interior is, in general, rigorously shut against christians; but Dr. Richardson contrived to effect an entrance. He found it a magnificent square, 1489 feet by 995 feet the floors and walls of marble, and the *sakara* or inner shrine, 60 feet square, of the finest materials, and covered from the Koran.

Jerusalem is 35 miles from Joppa, 80 from Tiberias and Nazareth, 110 S of Tyre, 125 from Sidon and Damascus, 15 from the Dead Sea, and 5 N. of Bethlehem. It is 150 miles from Dan to Beersheba, and 80 miles from Joppa E. to Ammon W. The sea of Galilee is 13, and the Dead Sea 50 miles long.

De la Martine states, that the environs of

Jerusalem consist of mountains without shade, valleys without water, earth without verdure, rocks without interest, blocks of grey stone piercing the parched earth, gazelles or jackals prowling in recesses, here and there some vine-plants and pale olive-thrubs, a mastic or black carob tree, by exception, intercepts the distant horizon with melancholy sadness, the sky is never chequered by the smallest cloud,—no bird sings, and not a breath of air relieves the fainting pilgrim; nor is the city itself any improvement of the country; the streets are scarcely wide enough to permit two asses to pass, and the houses, for the most part, are not superior to Irish cabins. Its population, too, are so inactive, that he sat a whole day before one of the principal gates, and saw no one enter or depart! On the contrary, Syria from Galilee, in the valleys and western descents of Lebanon, in the valley of Bka, and around the splendid city of Scham or Damascus, realises all that poetry has fabled of paradise in luxuriance, produce, and human enjoyments. The Lebanon chains arrest the clouds.

The Damascus of the Bible, or *Sham* of the country, is the finest city in Syria, and in the East, in a country which is matchless for beauty and luxuriance. It is in the El Berbe, about 200 miles S. of Aleppo, and 150 N. by E. from Jerusalem.

At Palmyra, or Tadmor, in the desert, 150 miles E. by N. from Damascus, and 180 due E. from Baalbec, stands a row of Corinthian columns, a mile in length; and around, in connection, as part of a temple of the Sun, many other columns, arches, &c. &c. and others in prostration: the most wonderful assemblage, in a tract of which a square mile would not afford food for a dozen families. The erection is a prodigy.

LIMA, next to Mexico, the most splendid city of Spanish America, is situated about six miles in the interior, from its port of Callao. It is of a form nearly semicircular; two miles long, and one and a half broad; the base being washed by the river Limac. It is surrounded by a wall of brick and clay, twelve feet high. The houses run in straight lines, dividing the city into a multitude of squares of various forms and dimensions. They are built wholly of timber, cane, and unburnt brick, and are seldom more than one, scarcely ever more than two stories high; but those of the rich are surrounded by porticoes or open courts, enclosed by high walls and gates, which being, as well as the interior, painted with figures as large as life, and adorned with wooden pillars, coloured in imitation of stone, make a very gay appearance. The plaza, or principal square, is as in other Spanish cities, surrounded by all the finest edifices. The viceroy's palace, however, is an old plastered and unsightly structure. The apartments now employed as government offices display some vestiges of decayed magnificence. The cathedral is an elegant building, with a stone front, and two towers of considerable height; and the interior, particularly the great altar, is, or at least was, excessively rich. Close to it is the archbishop's palace, elegant, adorned with green balconies. There are twenty-five convents in Lima, with churches attached to them, and fifteen nunneries. The population of Lima is reckoned by Stephenson at 87,000, and by Proctor at above 100,000. No recent census has been taken.

LISBON is situated near the mouth of the Tagus, which may be here almost considered an arm of the sea, since not only the tide flows up, but the water is salt, and the swell often tempestuous. The approach to it presents a more magnificent spectacle than that of perhaps any other city of Europe. The city rises direct from the water, crowning the sides and summits of several hills. Palaces, convents, and churches, crown this amphitheatre of buildings; the dazzling whiteness of the houses, the light appearance of the windows and balconies; the tasteful arrangement of plants, shrubs, and flowers, on their roofs and terraces; the golden orange-groves which adorn the suburbs, and the stately specimens of Indian or American botany, which are scattered through the scene, produce an effect that cannot be described. The noble harbour, also crowded with vessels; numerous pilot and fishing boats, with their large, handsome lateen sails, ascending or descending the river, and nearer the shore hundreds of small neat boats, with white or painted awnings, finely vary the scene. The moment, however, that a stranger lands, and enters the place, he finds that he has been imposed upon by a brilliant illusion; and the gay and glittering city is found to resemble a painted sepulchre. The streets are narrow and ill-paved; the houses gloomy, with here and there a latticed window; filth and nuisances assault him at every turn. Lisbon does, indeed, appear to be the dirtiest and most noisome city on the face of the earth. In passing through the streets, a stranger encounters, at every turn, the most disgusting effluvia. Every species of vermin destined to punish indolence and slovenliness, the mosquito, the scolopendra, and a species of red ant, multiply to an extraordinary degree. Nor is Lisbon found, on inspection, to exhibit that architectural beauty which it promises on a distant view. It might have been expected, among 40 churches and 75 convents, built by a superstitious people, that there would have been some signal display of this kind; but this is not found even in the cathedral. Two handsome squares, however, have been formed—the Commercial and the Roscio, which are connected by well-built streets; but the absence of trees, or even shrubs, and the blinding sand that drifts through them, combine to produce a disagreeable effect. Lisbon derives an awful interest from the ruins, still left of the great earthquake of 1755, the most dreadful catastrophe which ever befel a modern European city; 6000 houses were thrown down, 30,000 inhabitants killed, and a conflagration kin-

dled, which spread still wider destruction. Lisbon displays one grand feature; the aqueduct. It is carried in one place through a tunnel, and in another over a defile, 230 feet deep, by arches, which are said to be the highest in the world. The width of the centre arch is 107 feet.

LONDON, the largest, most populous, and expanded City in Europe, is intersected by the Thames about 40 miles above its open estuary. It covers about 32 square miles, and expands in connected villages and villas over at least 40 square miles. The northern part consists of three parts,—the West, or court-end; the City; and the Eastern, or port-end; each as distinct, in pursuits and appearance, as though the other divisions did not exist. The Southern, or Surry division, resembles the Eastern end, or is a retreat from the bustle of the city. Other suburbs, to the North, resemble their approximate divisions.

One continued line of street extends from 4½ miles E. of St. Paul's to 5 or 6 W., chiefly trading, with a divarication, at St. Paul's, of 3 or 4 miles.

London, till the commencement of this century, was chiefly brick; but, since, a better style has prevailed, and a fifth of the Town is now faced with stucco, and buildings, for all purposes, are in architectural taste. In this general splendour, ancient structures have lost their effect. St. Paul's is still a wonder, and Westminster Abbey; but ranges of Club-houses, Banking-houses, Commercial Establishments, Dock Warehouses, New Squares, Public Offices, and fine Streets, such as Regent's Street, from Pall Mall to Camden Town, sink, in their taste and splendour, the best of former structures.

In mean time, the Town is expanding on every side, and every year produces additions equal to fine cities. Altogether, there is, within 5 miles round St. Paul's, nearly 200,000 houses, most of which are 8-room houses, for single families, and others of 20 and more. Within 50 years, London has doubled in extent, and quadrupled in splendour, attributable to increase of trade, rise in rentals of estates, annuitants of the public debt, and arrivals from the East and West Indies, and colonies all over the world, of which it is the common capital.

The Parliament Houses, in the swamps of Westminster, appear likely to be the most superb architectural structure in Gt. Britain.

Buckingham Palace has the same disadvantage of being raised in a swamp, but it is a very imposing structure, and in convenient juxta-position with the legislative and public establishments of the nation.

In the out-parishes, the increase in Hammersmith, in twenty years, from 1801 to 1821, was 535 on 871. At Hampton, 300 on 290. At Hampstead, 386 on 601. At Stoke Newington, from 208 to 398. Tottenham, 598 to 976. Edmonton, 901 to 1334. Bromley, 256 to 842; and West Ham, 1181 to 1722. Such were the facilities of mortgage to speculating builders, afforded by a paper circulation.

The number of houses assessed in 1830 was 116,279, at rentals of 5,143 340*l*., probably ⅓d below the real amounts. In London 53, in Westminster 277, and in Marylebone, 77 houses are assessed at rentals of 400*l*. and upwards; and of from 3 to 400*l*. there are in London 75, in Westminster 220, and in Marylebone 164. The totals for Middlesex, of these large premises, are 419 above 400*l*., and 487 from 3 to 400*l*.

In London, 27 houses are assessed for above 100 windows, 59 in Westminster, and 35 others in Middlesex. From 75 to 100 windows, there are 208 in the district.

London pays five-eighths of the house duties, and one-third of the window duties of England and Wales.

In 1831, within the bills	1,180,975
——— without the bills ..	273,587
Total population	1,454,562

The following Parishes adjoin London in regular continuity:—

Hammersmith	10,222
Hampstead	8,588
Highgate	4,856
Stoke Newington	3,480
Bromley	4,846
Stratford	3,371
West Ham and Stratford	11,580
Deptford	13,759
Ditto	6,036
Greenwich	24,553
Camberwell	28,231
Clapham	9,958
	129,480
Adding, as above	1,454,562
London, in 1831	1,584,042

Besides a dozen other places in close juxtaposition, but not actually joined by continuous buildings.

Pigot's London Directory contains 1203 columns of classed names of trading and professional persons, and firms, 64 in a column, or the astonishing number of 76,992 establishments of trade or industry, of various magnitudes. The alphabetical list contains 404 names and firms in 171½ pages, making 69 286.

Of Public Establishments there were,—in 1831,

303 Churches and Chapels of the Established Church
22 Chapels for Foreigners.
364 Chapels for various Dissenters, Catholics, and Jews.
689 Religious Places.
150 Various Institutions.
250 Public Schools.
150 Hospitals, Infirmaries, &c.
156 Alms-houses, Work-houses, &c.
550 Public Offices, &c.
22 Courts of Justice; among which, we find the Star Chamber.
6 Courts of Request.
16 Police-offices.

14 Prisons.
31 Exhibitions, &c.
22 Theatres.
26 Club-houses.
12 Barracks.
46 Livery-companies' Halls.
3 Other Companies.
24 Markets.

There appear to be no less than 13,936 separate streets, squares, courts, alleys, &c. having distinct names.

The most striking circumstance in the list of employments, is the number of 2280 attorneys, and 1176 barristers and special pleaders, besides 105 conveyancers. The next prominent numbers are 4368 public-houses, besides 380 hotels and inns, 470 beer-shops, and 960 spirit and wine-shops. There are, also,—

Boys' Schools	567
Girls' Schools	992
Architects	270
Artists	400
Bakers	1948
Banks	71
Bookbinders	340
Booksellers	716
Boot and Shoe Makers	18[illegible]6
Master Bricklayers	704
Stock Brokers	320
Builders	340
Cabinet Makers and Upholsterers	768
Carpenters (Master)	1472
Chemists and Druggists	440
Circulating Libraries	188
Coach Makers, &c.	512
Engineers	132
Engravers	576
Furniture Brokers	704
General Shopkeepers	2349
Grocers	1600
Goldsmiths and Jewellers	896
Linen Drapers	704
Merchants	1800
Music Sellers	350
Opticians	104
Pawnbrokers	288
Physicians	280
Printers and Printers' Joiners	490
Stationers, wholesale and retail	630
Surgeons, &c.	1411
Tailors (Master)	2508
Tobacco and Snuff Dealers	704
Wine and Spirit Dealers	960
Watch Trades	864

Boyle's Court Guide for the current year gives a list of about 10 000 private families resident in the squares and fashionable streets.

The 185,000 houses in London expend, one with another, a pound per day, or 67½ millions per annum, one-third of the national income.

There are 1342 chambers in the Inns of Court, in London.

The religions of London may be partly estimated by the numbers of buildings devoted to each.—343 Church of England, 6 French, 7 German, 2 Swiss, 2 Dutch, 7 Welsh, 1 Bavarian, Armenian, Irish, Russian, and Swedish

There are also 3 Arians, 15 Unitarians, 77 Baptists, 124 Independents, &c., 6 Lady Huntingdon's, 36 Methodists, 14 Scotch Presbyterians, 4 Swedenborgians, 8 Quakers, 29 Catholic, 11 Synagogues 2 Moravians, 2 Free-thinkers, 2 Deists, 3 Huntingtonians, 3 Bethel Unions, 1 New Jerusalem.

In all, 700 churches and chapels; and if we assign to each at twice per day 400, we get 400 + 700 = 280,000, who are religious, out of a population of a million, above six years of age. In age and sex, they may be divided into 100,000 children, 120,000 females, and about 60,000 men. About 100,000 may, too, be considered as attached to the 343 Church of England, and 180,000 to the others.

The population of London consume 110,000 bullocks, 776,000 sheep, 250,000 lambs, 250,000 calves, and 270,000 old and young pigs. Besides 900,000 quarters of wheat, and 1,000,000 chaldrons of coals, or 6 to a house; and all necessaries and luxuries, equal to an expenditure of 3 or 400*l.* a year to every house.

Oxford street, the longest in London, is 2304 yards, and numbers 225 houses on each side; 21 cross-streets, of 20 yards, occupy 4[illegible]0 yards, and leave 24 feet 10 inches on the average to each house. Regent-street, the handsomest in London, 1732 yards. Piccadilly, 1732. London presents two grand lines from east to west, never half a mile apart; Oxford-street, St. Giles's, Holborn, Newgate-street, Cheapside, Cornhill, Leadenhall-street, Aldgate, and Whitechapel. The southern line is Piccadilly, Regent-street, Charing-Cross, the Strand, Fleet-street, Ludgate Hill, St. Paul's, Cheapside, Lombard-street, Fenchurch-street, Aldgate, and Whitechapel.

The City, under the Lord Mayor, is the centre, extending from Temple-bar to Aldgate, and from the river to Moorgate, containing but 17,170 houses, and 125,434 inhabitants. It is divided into 26 wards, each with an alderman for life, and common-council elected annually; the executive officers being the Lord Mayor, and two sheriffs for city and county.

The LIVERY of LONDON are freemen, who are members of companies on taking an oath, paying fees, and being invested with a livery-gown of purple silk and fur. In these 12 or 15,000 persons are vested the corporate duties in common-halls, &c. The purchase of the freedom costs about 30*l.*, and the livery from 35*l.* to 200*l.* or 300*l.*

The local revenues of the City of London, in 1831, were 152,000*l.*, and the expenditure 150,000*l.*

In London, there are two new colleges, the KING'S COLLEGE, at Somerset-house, specially patronized by the high Church; the LONDON UNIVERSITY, near Tavistock-square, chiefly patronized by the dissenters. They have professors and lecturers in all branches of study.

There are, in London, 28 hospitals, infirmaries, and asylums, mostly on a large scale.

There are 37 societies in London, devoted to various literary and scientific objects.

There are 30 societies in London, for various charitable and useful objects.

There are 40 institutions for special diseases in London.

Christ Hospital, in London and Hertford, boards, cloaths, and educates 1300 children.

St. Bartholomew's Hospital, in 1833, cured or relieved 5164 in-patients, and 12 977 out-patients, and constantly accommodates 480 in, and 700 out patients.

St. Thomas's 2886 in-patients, and 25,430 out, having 400 in, and 1800 out.

In connection with education in London, there are, at least, 30 royal endowed schools, 100 considerable charity-schools, the British and Foreign School Society, (Lancaster's), the National Society, (Bell's), the Society of School-masters, the St. Anne's Schools, the Welsh School, the Hibernian School, &c. &c.

The Editor of this volume may name his own institution of the Sheriff's Fund, which he instituted in 1807, for the relief of destitute prisoners and their families, and for temporary provision, on their discharge from custody. Its capital is now nearly £9000.

Three of the London theatres hold 2500 persons each, three others 1800, and ten others about 800 each, in all nearly 20.000; but those open at one time are equal only to 10 or 12,000

In 60 years, the Magdalen Hospital received 4594 females; of whom, 3012 were restored to their families.

The following are the dimensions of the London Bridges:—

	Length.	Arches.	Width.
London........ feet	930	5	55
Southwark	708	3	40
Blackfriars	1100	9	41
Strand	1239	9	42
Westminster	1223	13	44
Vauxhall	860	9	40

By far the most superb bridge in the world is the new *London Bridge*. It crosses the Thames in only 5 arches; the centre 152 feet, and the others 140 and 130. It contains 120,000 tons of granite with solid piers. The passage is 53 feet, or foot-ways 9 each, and 35 for carriages.

Next to London Bridge, the Southwark, of iron, claims attention, with its centre arch of 240 feet, and its side ones 210. The centre rises 24 feet, and weighs 3046 tons of iron, and the others 2600 tons each.

The *Strand* bridge has 9 elliptical arches, 120 feet span, and 35 feet rise. The piers 20 feet, and road 28 feet. The materials of both are granite, of 2 tons to the cubic yard, bricks of 1 ton, and earth 1·125 ton.

The Dock Companies are, the London, the East India, West India, Commercial, Grand Surrey, and the St. Katharine's.

The docks of London, in imitation of those of Liverpool, but of greater magnitude, are in order from West to East: St. Katharine's near the Tower, 1823; the London docks adjoining, 1805; the West India docks, across the Isle of Dogs, 1802; the East India, at Limehouse, 1806; and on the Surrey side the extensive Commercial docks, and Surrey docks, 1827. The West India docks cover 62 acres, and accommodate above 500 ships. The London 23 acres; the East India 30 acres. The St. Katharine's cover 24 acres, and accommodate 1400 vessels.

2000 ships are commonly in the river and docks, and 3000 barges. About 2300 barges ascend the river and canals for inland trade. And these and 3000 boats employ 8000 watermen; and, in the docks, &c. 4000 labourers.

The annual supply of sacks of flour to Mark-lane is from 4 to 500 000. In 1828-9, it was 523,106; in 1829-30, 368,888; and, in 1830-31, 412,876. The oats brought to market, in the same years, were 1,530,425, 1,145 754, and 901 440 quarters. The malt 246 905, 219,478, and 234 137 quarters.

London consumes 65,000 pipes of wine, 100,000 gallons of spirits, and 2 millions of barrels of porter and ale.

The consumption of London, taking the population at 1,400,000, is as under:—

Smithfield Market	160	millions
The out-parishes	27	
Pigs, fish, and poultry........	160	
The out parishes	27	
Butter, cheese, and eggs	100	
Milk 29 million quarts	58	
Bread......................	320	
Other flour	80	
Other grain for man	100	
Potatoes, vegetables, &c.	400	
Sugar, coffee, &c............	160	
Total per annum	1592	millions

Which, divided by 365 × 1 4 millions, is exactly 3 pounds and 2 ounces per individual per day; which may be taken at 10 ounces for breakfast, 24 ounces for dinner, and 16 ounces for tea and supper. All independent of wine, spirits, drugs, horse-keep, &c. &c.

In the provinces, the quantity is not less per diem; but the proportions vary, and 23 millions in the United Kingdom demand an average 450 pounds annually of various food per acre, from the 56 millions of cultivated acres, for the ordinary sustenance of the population.

The gas-lights of London consume 55,000 tons of coals. There are about 66,000 in-door lights, and 8600 out-door, on the average equal to 50 candles per light. Half-inch pipes are estimated equal to 20 candles; 1-inch to 100, and 2-inch to 420 candles.

About 25 mining companies were formed in London, for South America, in 1825, and 6 or 7 still exist.

London was not paved at the Conquest. The first toll for repairing a road was from Temple Bar to Saint Giles's, the place of execution in the reign of Edward III. Holborn was paved in 1417. The first, or Westminster Paving Act, passed in 1762. London was first lighted in 1414, with private lanterns. In 1736, they were increased from 1000 to 5000. In 1744, the first lighting act passed. In 1820, gas was generally substituted for oil.

Coaches were introduced about 1510. In 1550, there were but three in Paris. They were first let to hire at the Hotel St. Fiacre, under the name of cabriolet, or cabs, with one horse; they were first used in Paris, and, about 1824, in London. There are now about 500 coaches and chariots, and 1500 cabriolets. 80 Omnibuses run between the Bank and Paddington, and 75 from the Bank to the Edgeware Road. 280 pass daily through the Strand.

London is built on a bed of gravel; beneath which is a stratum of blue clay, 200 or 300 feet thick, below this, sand; and then a stratum of chalk, which bassets in Bedfordshire and Oxfordshire, and conveys, on its hard surface, the water under the clay and sand. Hence, the gravel supplies some water; but, for a constant supply, it is necessary to penetrate through the blue clay, to the sand and chalk. It is then so abundant as to flow up like a fountain, and where bored only, to a height of 15 or 20 feet.—*Middleton.*

London is so vast, because it is not merely the capital of the United Kingdom, but of the colonies and colonists, in all parts of the world.

The mean heighth of high-water at the London Docks varies from 22 feet 10 inches to 19.5.

Lombard-street is 34 feet above high-water level. The New Post-Office 46 feet. Drury-lane 65. Holles-street 76. Hyde Park corner 78 feet. The highest ground, near London, is the top of Hampstead heath, 445 feet above the level of the Thames, at mean high-water. Highgate church is 438, Shooter's hill 430, and the top of St. Paul's 420. Large parts of London are not 10 feet, and three-fourths not 30 feet above the Thames.

Lincoln's Inn Square is 770 feet per side, or 13½ acres. Russell 670, or 10 acres. There are 40 good squares in London, from 3 to 8 acres.

The enormous wealth of London appears in the returned *rentals* of several parishes: —thus, Mary-le-bone 678 808*l.*; St. George, Hanover-square, 485,576*l.*: St. Pancras 357,820*l.*; St. James's 222,616; St. Giles's 265,548*l.* &c. and real rents are always higher.

In 1832, London imported 2,139,078 tons of coals; and, in 1831, 2,045,292 tons, *i. e.* about 12 tons to a house, at about 28*s.* per ton.

There are 60 serious fires per annum in London, on the average, and one alarm per day.

Plagues and contagious diseases have been fatal to London.

In 1348	....	100 000 died
1407	....	30 000
1472	....	40,000
1500	....	20,000
1518	....	23,000
1528	....	25 000
1603	....	30,578
1625	....	35,417
1665	....	68,596

THAMES TUNNEL.—This vast undertaking, forming a communication under the River Thames, between Rotherhithe and Wapping, was, after numerous difficulties, finally accomplished and opened on the 25th of March, 1843. This master-piece of science was commenced by Sir J. S. Brunel in 1824. The length of the Tunnel is 1200 feet. The width 38 feet, affording room for carriage and foot passengers. The total cost of the work completed to the present time, is £446,000.

MADRAS is the capital of the Carnatic coast, and that of the British possessions on the eastern coast. The choice, as in many other countries, has not been so happy as that made by the French; Pondicherry being every way a finer and more convenient station. Madras has no harbour, but a mere road, through which runs a strong current, and which is often exposed to dangerous winds. Fort St. George, planned by Robins, and placed at a small distance from the sea, is a strong and handsome fortress, not on so great a scale as Fort William at Calcutta, but more advantageously situated. The public offices and storehouses form a range of handsome buildings along the beach, their upper stories being adorned by colonnades resting on arched bases. With this exception, European Madras is merely an assemblage of country-houses situated in the midst of gardens, and scattered over an extent of several miles. The houses consist usually only of one story, and are of a light and elegant structure, having porticos and verandas supported by columns, covered with *chunam*.

The Black Town is extensive, and the scene which it presents of minarets and pagodas, mixed with trees and gardens, is striking; but the interior, like that of most Asiatic towns, consists of poor bamboo cottages thatched with leaves. There are, however, some great native merchants, who have splendid mansions in the oriental style.

MADRID, the Capital of Castile, and of "all the Spains," stands on several low hills on the immense Castilian plain, which on the North appears bounded by the high distant range of the Guadarama, but on every other side has no visible termination. A small rivulet, the Mangaranes, flows past the city and falls into the Tagus. Madrid is a superb, but somewhat gloomy capital; the houses are high, well-built of good stone, not defaced by smoke; the streets are well-paved, and have broad footpaths. The main street of Alcala, long, spacious, and bordered on each side by a row of princely houses, attracts particular admiration. The Prado, a wide public walk, bordered by trees, and connected with gardens, all open to the public, is equally conducive to ornament and pleasure. There are many public fountains, supplied with pure, light, and salubrious water, filtered through beds of gravel and sand, from a distance of 7 or 8 leagues. The gates, built by Charles III., are uncommonly beautiful, particularly that of Alcala. The royal palace, built by Philip V.

is a spacious and magnificent structure, and contains numerous fine paintings. The Retiro, with its fine gardens, was defaced by the French, who made it a military post; the museum of statuary and painting, a new and elegant building, has recently been enriched with some of the finest pictures from the royal palaces. The cabinet of natural history, supported by the government, is also a handsome structure, and its contents valuable. The environs of Madrid are not remarkable for beauty; they are much broken into hills and hollows; so that, of the 200 villages situated in them, only 3 or 4 can be seen at once.

MECCA—Is a considerable city, one of the handsomest in the East. It stands in a narrow valley, enclosed between rocky hills, following their sinuosities, and partly built on their declivities; the fronts of the houses are of stone, raised to the heighth of three or four stories, and ornamented with columns and architectural ornaments. The resort of devotees of so many nations, from the extremities of Tartary to the banks of the Senegal, render Mecca a very flourishing city; and it has been supposed to contain 100,000 inhabitants. Burckhardt reckons only 30,000. The Wahabite war, from which it suffered deeply, rendered the avenues to it no longer secure, especially as the Wahabites, though they themselves reverenced the holy places, shut them against the approach of those whom they deemed heretics; but since they came into the possession of Mohammed Ali, they have been thrown open to the Mahometan world, and pilgrims are protected. The temple of Mecca forms a very spacious square, about a quarter of a mile in each direction, with a triple or quadruple row of columns. A number of steps lead down into the interior, containing the object sacred to a Mahometan eye, the *Kaaba* or house of the prophet, and within it is the black stone brought by the angel Gabriel to form its foundation. To kiss this sacred stone, to go round it seven times, reciting appropriate hymns, form the completion of that religious service for which thousands of miles are travelled. The last ceremonial is ablution in the well of Zemzem, which, though itself not the purest water, is supposed to cleanse the votary from all sin. A pilgrimage, often tumultuary, to Mount Arafat, completes the round of observance.

MEXICO stands in the centre of a valley; the ancient Mexico, or Tenochtitlan having been built in the middle of a lake, and connected with the continent by extensive causeways or dikes. The new Mexico is three miles from the lake of Tezcuco, and nearly six from that of Chalco: yet Humboldt considers it certain, from the remains of the ancient *teocalli*, or temples, that it occupies the identical position of the former city, and that a great part of the waters of the valley have been dried up.

Mexico was long considered the largest city of America; but it is now surpassed by New York, perhaps even by Rio Janeiro. Some estimates have raised its population to 200 000, but it may, on good grounds, be fixed at from 120,000 to 140,000. It is beyond dispute the most splendid of its rivals. The architecture is generally in a very pure style, and there are edifices of very beautiful structure. The palace of the late viceroys, the cathedral built in what is termed the gothic style, several of the convents, and some private palaces, reared upon plans furnished by the pupils of the Academy of the Fine Arts, are of great extent and magnificence; yet, upon the whole, it is rather the arrangement, regularity, and general effect of the city, which render it so admirable. Nothing can be more enchanting than the view of the city and valley from the surrounding heights. The eye sweeps over a vast extent of cultivated fields, to the very base of the colossal mountains covered with perpetual snow. The city appears as if watered by the waters of the lake of Tezcuco, which, surrounded by villages and hamlets, resembles the most beautiful of the Swiss lakes, and the rich cultivation of the vicinity forms a striking contrast with the naked mountains. Among these rise the famous volcano Popo-Catepelt, and the mountains of Iztaccihualt, of which the first, an enormous cone, burns occasionally, throwing up smoke and ashes in the midst of eternal snows. The police of the city is excellent; most of the streets are handsomely paved, lighted, and cleansed. The markets are remarkably well supplied with animal and vegetable productions, brought by crowds of canoes along the lake of Chalco, and the canal leading to it. Most of the flowers and roots have been raised in *chinampas* or floating gardens, an invention peculiar to the New World. They consist of rafts formed of reeds, roots, and bushes, and covered with black saline mould, which, being irrigated by the water of the lake, becomes exceedingly fertile. The construction of a *desague*, or canal to carry off the waters of the lake Zumpango, and of the principal river by which it is fed, has prevented any very desolating floods. The desague cost £1,040,000, and is one of the most stupendous works ever executed.

MILAN is a noble city, which ranks almost as the modern Capital of Italy. Its situation, in the middle of a superlatively rich and beautiful plain, watered by the Po, at a point where all the great canals meet, and on the high-road from Germany by the lakes Maggiore and Como, render it a sort of key to Northern Italy. Its greatest splendour was attained under the regime of France, when it became the capital, first of the Italian republic, and then of the kingdom of Italy. Napoleon spared no expence in erecting edifices. The Duomo, begun in the 15th century, under the Viscontis, and slowly carried on by successive benefactions had been left more than half unfinished; so that the French had the greater part of its magnificent front to execute. It is the only very superb edifice of this description which

belongs to the present age. In extent and pomp it ranks second to St. Peter's. It is 454 feet long by 270 feet wide; the heighth of the cupola is 232. and that of the tower 335 feet. The French also erected a very magnificent amphitheatre, in which from 30,000 to 40,000 spectators can be accommodated, and chariot races and national games have been repeatedly performed. A superb triumphal arch was commenced on the Simplon road, in commemoration of the stupendous labours by which that passage over the Alps was formed; but, since the sacrifice of Napoleon, no progress has been made. The theatre, Della Scala, is the only very fine one in Italy. Here the French deposited the finest paintings which could be procured by purchase, or otherwise, from every part of Italy, including the brilliant productions of the Bolognese schools. The Ambrosian library, formed by Cardinal Frederic Borromeo, on the basis of the Benedictine collection, consists of 90,000 volumes, and 15,000 manuscripts. Milan has an infirmary for 3600 sick, and a foundling hospital for 4000 children. It covers a great space of ground, and has some very spacious squares; but the streets, in general, are narrow and crooked.

MOROCCO.—This capital is situated on a very extensive and naturally-fruitful plain, above which rises abruptly, covered with perpetual snow, one of the loftiest ranges of Atlas. The mosques are numerous, and several of them present striking specimens of Arabian architecture, particularly that called El Koutouber, the tower of which is 220 feet high. Of the eleven gates, one is richly sculptured in the Moorish style. The palace forms an oblong of 1500 yards by 600 yards, divided into enclosures, where, surrounded by gardens, are the pavilions and treasury of 15 millions, of the sovereign, his principal officers, and ladies. The floors are tessellated with variously-coloured tiles; but a mat, a small carpet and cushions, compose the entire furniture. Beautiful gardens surround the city, and spacious aqueducts, conveying water from the Atlas, twenty miles distant, bear testimony to a superior state of the arts in former times.

MOSCOW, the ancient Capital of Moscovy, was, perhaps, the most extraordinary city that existed either in Europe or Asia. It surpassed, in splendour, the greatest capitals of Europe, and in poverty its poorest villages. "One might imagine," says Dr. Clarke, "that all the states of Europe and Asia had sent a building, by way of representative to Moscow: timber-huts from regions beyond the Arctic; plastered palaces from Sweden and Denmark, painted walls from the Tyrol; mosques from Constantinople; Tartar temples from Bucharia; pagodas, pavilions, verandas, from China; caberets from Spain; dungeons, prisons, and public offices from France; architectural ruins from Rome; terraces and trellices from Naples; and ware-houses from Wapping." Among the wonders of Moscow is the greatest bell in the world: 67 feet in circumference, weighing more than 22,000 tons. Napoleon, when he entered Moscow in 1812, did not find it burning; but the flames of Rostopchin soon appeared; and, aided by strong winds, gained hourly new strength, till they wrapped the vast capital in one blaze of fire. When Mr. Jones visited the city in 1814, the whole space of 25 miles circumference presented the most gloomy aspect of desolation. In 1823, however, Lyall and Cochrane found the work of reparation far advanced; and the new streets and edifices were constructed in a more regular style; 6341 houses had been burned, and 6027 had been re-built. On Sparrow-hill, Alexander, in 1817, laid the foundation of "a Temple of our Saviour," which, if completed, will be 770 feet high (the great pyramid is only 630 feet), having three successive churches rising above each other, the lowest of which was to be fronted by a colonnade 2100 feet long. 24,000 peasants were provided, of whom 6000 were to work at the building, and the rest to till the ground for their support.

MUNICH.—This capital lies in an extensive plain, on the Iser; and though it cannot boast any thing which suggests ideas of unusual grandeur, either ancient or modern, it is very handsome, and full of well-built modern houses; the streets are broad and well paved. Hassel ranks it among the handsomest cities in Germany. But the cathedral of Notre Dame, though of vast extent, and with towers 350 feet high, is declared by Dibdin to be frightful in the extreme, built of red brick, without ornament, design, or expression, and not of earlier date than the 15th century. The church of St. Michael, in which the public library is deposited, is more elegant, and its interior is one of the finest in Europe. The palace has also been considered a good specimen of modern architecture. The six suburbs comprise nearly half the town, containing 1419 out of 3613 houses.

NANKIN, the ancient capital of China, is, in extent, superior to Pekin. The exterior wall, enclosing the suburbs, resembles rather the boundary of a province than of a city. Since the government and tribunals, however, were transferred to Pekin, it has greatly declined, and about a third part of its area is now uninhabited. It still continues to be the greatest manufacturing city of China. Its silks, its paper, the cottons bearing its name, are preferred over the empire to those made elsewhere. Learning, also, continues to flourish in an unrivalled degree; the boo sellers' shops are no where so amply furnished; and a greater number of doctors are sent forth from it than from any other city. Nankin contains, also, in its pagoda, or porcelain tower, the chief architectural monument of the empire.

NAPLES—is the largest city in Italy

and the most beautiful of European capitals. The edifices are lofty and solid, and the streets tolerably wide, particularly the Strada de Toledo, which is a mile in length. Taken collectively, Naples presents to the sea an immense line of lofty edifices, producing a general pomp of effect, and forming a commanding feature in a matchless landscape. Its bay occupies a wide circuit of 16 miles, every where bounded with vineyards, hills, woods, convents, and villages; the golden shores of Baiæ, the beautiful variegated islands of Ischia and Procida, with the verdant sides and lofty cone of Vesuvius: all these, viewed under a bright sun, have been considered as composing the most splendid picture which nature and art presents to the human eye. The interior of Naples exhibits a most singular living scene; every trade and every amusement being carried on in the open air. "The crowd of London," says Forsyth, "is a double line in quick motion; but the crowd of Naples consists in a general tide rolling up and down, and in the middle of this tide an hundred eddies of men. You are stopped by a carpenter's bench; you are lost among shoe-makers' stools; you dash among the pots of a maccaroni stall. Every bargain sounds like a battle: the popular exhibitions are full of grotesque; they consist of Punch, held up as the representative of the nation; of preaching; dancing to the guitar; or listening to old tales."

A literary spirit prevails, and the Neapolitans boast, that as many books are published at Naples as at Paris; and that, if the world would judge impartially, they would find the one as good as the other. Most ample opportunities of study are certainly afforded by 4 libraries, open to the public; one of which, compounded of the Farnese and other libraries transported from Rome, comprises many curious and valuable works. With these were conveyed some of the finest specimens of ancient sculpture, the Torso, the Hercules, the Urania; and some fine specimens have been appended from the greatest Italian schools. One bright redeeming quality in the Neapolitans is charity: their hospitals are numerous, richly endowed, and supported by ample benefactions; and persons of the first rank, assuming the dress of religious fraternities, not only superintend these establishments, but watch the sick bed of the patient. The Neapolitans set an example which seems worthy of imitation, in having a rural hospital for recovering the health of invalids. They have also *conservatorii*, or schools, where the children of the lower ranks are initiated in trades. A great part of these is devoted to the teaching of music, for Naples may be considered as the musical capital of Italy: the greatest composers have been its citizens, and its Opera is unrivalled.

NEW YORK, though not the seat of the principal government, may be considered, in many respects, as the capital of the American Union. It is the largest, the most wealthy, the most flourishing, and the gayest of all its cities. It is situated on the island of Manhattan, at the mouth of the Hudson, looking towards two channels formed by Long Island, one with the coast of Connecticut, called the Sound, or East River, the other with the coast of New Jersey. In these channels, and in the harbour, which admits vessels of 90 guns, the united navies of the world might lie in safety. New York is the greatest commercial emporium in America, and, next to London, the greatest in the world. In it, centre almost all the shipping and trade. The old part, indeed, where the great stir and business is still carried on, appears confused, crowded, and incommodious. But there are two streets, called the Broadway and the Bowery-road, which are long, spacious, and filled with handsome houses and shops. The Broadway is continued for upwards of two miles through the centre and highest part of the city, and contains many handsome houses, built of red-brick. For a certain space, it consists of private mansions; after these, appear a range of shops, which are said to vie in magnificence with those of London.

The city hall is considered to have scarcely a rival in the Union. It is 216 feet long, 105 broad, and 51 high, built mostly of white marble, and with good taste. The benevolent institutions of New York are very numerous; and the state prison and penitentiary are constructed on a large scale, supplied with working implements, as conducive to the reform of the criminals. The society in New York is numerous and gay, being composed of a great number of wealthy individuals. The upper class consists of rich merchants, leading professional men, and public functionaries; the second class, of shop-keepers, clerks, and subordinate officers of government. There are two or three colleges and public libraries, though not on any great scale; but literary taste, and the desire of information, are rapidly spreading.

PARIS, the Capital of France, has made pretensions to be considered the general capital of the civilized world. London can, in fact, alone dispute its claim, being more extensive, more wealthy, and the seat of a much more extended commerce; yet, the central situation of Paris, the peculiar attractions rendering it the crowded resort of strangers, and its brilliant and polished society give to this City a gayer aspect, and render it a more conspicuous object in the eyes of Europe. Paris, as a whole, is not only less populous than London, as 1,000,000 to 1,500,000, but, in proportion to its population, it covers less ground. It forms, on both banks of the Seine, an ellipse of about 4 miles in length and 3 in breadth. The principal streets are long, narrow, bordered by high houses, which are each occupied by several families.

The most distinguished of the palaces is the Louvre, finished with splendour, in the style that distinguished the age of

Louis XIV. Its front, 525 feet long, is a model of symmetry. The Louvre is not now occupied as a palace, but as a grand dep^t of the objects of taste and art. The gallery, which is more than a quarter of a mile long, and the walls of which are entirely crowded with paintings, forms a magnificent coup-d'œil. The hall of statues is also adorned with some of the finest specimens of ancient sculpture. The Tuileries, which has been the late royal residence, was begun at an earlier period than the Louvre, and carried on at successive times, is, on the whole, a noble edifice, surrounded with fine gardens and avenues. The palace of the Luxembourg on the south of Paris, and the Palais Bourbon on the west, are edifices of great taste and beauty. The former, now stripped of the famous paintings by Rubens, which have been transferred to the Louvre gallery, affords, in one part, a place of assembly for the Chamber of Peers, and, in another, apartments for the exhibition of paintings by living artists; while the Palais Bourbon is, in part, occupied by the Chamber of Deputies. The Palais Royal is no longer exclusively a palace, but is in part leased out to sundry persons for purposes of business and pleasure, and filled with shops, coffee-houses, taverns, gaming-tables, and every form of gaiety and dissipation, which can find acceptance in such a city. Nôtre Dame, the ancient cathedral of Paris, is somewhat heavy and massive. The modern church of St. Genevieve, called, during the Revolution, the Pantheon, was destined to eclipse both St. Peter's and St. Paul's. St. Sulpice is also a modern structure. Paris has few fine streets. It boasts of its *places*, which, without having the regular form or dimensions of a square, command admiration by the ranges of noble buildings that surround them. In particular, the place Louis Quinze, standing in a central situation among the palaces, presents one of the most brilliant points of view to be found in any city. This capital possesses also great advantages in the wide ornamented open spaces, which lie in the very heart of the city. The Boulevards, the ancient rampart of Paris, when it was circumscribed within a much narrower compass, are now converted into walks, adorned with rows of trees, and filled with numerous exhibitors, and vendors of every thing that can conduce to public amusement. The gardens of the Tuileries, and the embellished spot called the Champs Elysées, are sources of enjoyment. Under Napoleon, Paris was so much improved and embellished, that it deserves to be called *the City of Napoleon*, and his statue properly stands on a column in the highest elevation of the city, as a testimony of national gratitude.

There are 14 hospitals for the sick, and 8 *hospices* for the infirm. The former receive annually 42,500, of whom about 40,000 go out cured. The latter 18,500. The annual expence is about 280,000*l*. There is, besides, an office of charity in each of the 12 arrondissemens, the aids of which are administered by "sisters of charity," who divide the poor among themselves, make regular lists of them, and pay frequent visits. They make an annual collection in their district, the produce of which is transmitted to the office. The annual distribution made by the offices of charity amount to 50,000*l*. in money, 717,000 quartern loaves, 270,000 lbs of meat, 19,000 ells of cloth, &c. The manufactures of Paris are principally works in gold and silver, which employ 7000 or 8000 workmen, and yield a value above 5,000,000*l*. sterling. There are manufactured, also, by 2000 workmen, 80,000 gold and 40,000 silver watches, with 15,000 clocks, which may be worth 750,000*l*. Sugar refinery is also supposed to produce 20,000,000 lbs., worth 1,300,000*l*. There are 80 printing-offices, employing 600 presses, and 3000 workmen, and using annually 280,000 reams of paper, supposed value 350,000*l*. Of the various articles above enumerated, there are exported nearly 2,000,000*l*. sterling.

The most superb palace in Europe is that of VERSAILLES, about 12 miles from Paris, built by Louis XIV., and enlarged and extended by Louis Philippe, so as to present a gallery of works of art, several miles long; in fact, the wonder of all Europe.

Paris, in 1831, consumed 16½ millions of gallons of wine, 600,000 gallons of brandy, 250,000 gallons of beer, 2½ millions lbs. of grapes, 76,000 oxen and cows, 62,867 calves, 288,203 sheep, 76,741 pigs. 2½ millions lbs. cheese, 10 millions lbs. of butter. 1500 or 1600 sacks per day of flour, weighing 334 lbs. each. Besides 150,000*l*. worth of fish, and 260,000*l*. worth of fowls and game.

PEKIN.—This celebrated capital of a great empire stands almost in a corner of it, only 40 miles from the great wall. It consists of two very distinct parts, the Chinese and the Tartar cities, of which the former is the most elegant and populous, but the latter is adorned by the imperial palace and gardens. The united city is about twelve miles in circumference, surrounded by walls, like every other in China; but those of Pekin are peculiarly lofty, and completely hide the city from those who are without. The population has been a subject of controversy. The English embassy calculated it at 3,000,000. The Russian embassy judged it only double the size of Moscow, and as containing nearly as much unoccupied ground; which would infer only 600,000 or 700,000. The estimate of Le Comte is 2,000,000. Pekin is divided into regular streets, the principal one of which crosses the whole city, and is about 120 feet wide. It consists chiefly of shops, which, though, like every other edifice in the empire, seldom exceed one story in height, but are adorned with flags, varnish, painting, and lanterns of peculiar and elegant construction. The streets are immensely crowded, as the Chinese spend much time in the open air.

PETERSBURG.—The entire creation of its great founder, Peter I., and built upon

a plain, is the most regular, and, in appearance, the most splendid Capital in the world. It has no old, dirty, irregular quarter abandoned to traffic, and shunned by the opulent and fashionable; and there are no straggling suburbs. It is "a city of new palaces;" wanting thus, however, the solemn and venerable effect produced by structures that belong to a former age. A few of the palaces and public edifices are of marble and granite, but the city is built of brick covered with plaster resembling stone. Petersburgh is built entirely amid the waters; it occupies the South and North banks of the Neva, comprising several large islands enclosed by its channel. The ground on which it stands being almost on a level with the river, it is exposed to dreadful inundations. When a strong and continued west-wind blows in the waters of the gulf of Finland, the Neva rises sometimes eight feet, and overflows the whole city. It took place in 1824, on a very awful scale; for two days, Petersburgh and its neighbourhood were covered as with a sea, in which waggons, furniture, boats, provisions, even wooden houses and coffins, floated in confused masses. Eight thousand people were supposed to have perished, and the destruction of property was immense.

The streets and edifices are divided into several compartments, separated from each other by the interposed channels of the Neva. The principal is what is called the Admiralty quarter. It is situated along the South bank of the Neva. It is faced towards the river by a magnificent granite quay, extending 3 miles in length; and here are grouped all the most magnificent structures of Petersburg, which resemble a vast range of fine palaces. The Admiralty itself, a quarter of a mile in length, presents, perhaps, the longest façade in Europe, richly ornamented. Three broad and fine streets, about two miles long, branch from this central edifice, which terminates the vista of each. The grandest structure, however, is the Imperial winter palace, 450 feet long, 380 broad, and which, with an adjoining wing, called the Hermitage, contains the most valuable of the imperial collections. On a smaller scale, but of still richer materials, is the marble palace, resting on a basement of granite, and roofed with copper. The new Bank is also considered one of the chief ornaments of Petersburgh. But the greatest of all is the cathedral church of Kasan, in the second Admiralty quarter, one of the most splendid structures that modern art has produced. It was begun in 1800, and finished in 15 years, at an expence of 15,000,000 rubles. It was executed entirely by Russian workmen, and of materials, which, though of the richest description, were all furnished within the empire. In the same quarter is the colossal equestrian statue of Peter the Great, chiefly remarkable for the mass of black marble on which it is placed, weighing 1,500 tons, and in this respect incomparable. The Vasili Ostrov (Basil's Island) is the chief insular compartment, containing the custom-house, exchange, and other establishments for commerce; and the academies of science and art. The island which bears the name of St. Petersburgh, and the quarter of Wiborg, on the northern bank, include the remains of what was the original city, or rather village with large additions, but still retaining more of a rural character than the rest. The foundry quarter is distinguished by the large establishments bearing its name, but still more by a very superb structure of Catherine, called the Taurida palace. At the end of a vestibule and hall, both of immense extent, and adorned with vast ranges of columns, statues, and vases, appear gardens, which, in winter, while all the world without is buried in ice and snow, present the most brilliant hues of summer. Being enclosed in a spacious saloon, they may be considered as a vast conservatory. The islands and opposite banks of the Neva are connected only by pontoons, or bridges of boats, which, on the approach of ice, are removed in 2 or 3 hours; and the ice then supersedes every other bridge. The ground in the vicinity being barren, the city is supplied from a great distance with cattle from the Ukraine; grain, and even timber fuel, from the provinces on the Volga; yet, the sure demand produces a steady supply.

The country residence of the Russian sovereigns is 22 wersts on the road to Novogorod, and is called the Czarskoselo. It is a large and very splendid palace, where the imperial family have resided for 70 years.

PHILADELPHIA, the Capital of Pennsylvania, is one of the most interesting cities of the Union. It occupies an oblong space, enclosed by the confluence of the rivers Delaware and Schuylkill. It was laid out on a regular plan, the streets being straight, and crossing each other at right angles. They are well-paved, and kept clean; so that it is a neat, commodious, and elegant city. The literary establishments of Philadelphia are the most respectable of the new continent. The library now comprises 24,000 volumes of valuable works. There is a museum, containing many interesting curiosities, particularly the entire skeleton of a mammoth. The seminary founded by Franklin, as an academy and charity-school, is now called the University of Pennsylvania, and, in medical science especially, has no rival in any of the States. The academy of fine arts possesses an extensive collection of casts, and of ancient and modern paintings. The American Philosophical Society has made some important contributions to science. Printing is carried on upon a greater scale, and more elegantly than in any other trans-Atlantic city. There were, in 1819 fifty-one offices, employing 153 presses, partly in newspapers, and partly in reprinting popular British works. It is celebrated by its philanthropic exertions. The attempt to mitigate the severity of the penal laws, by the penitentiary system, has been diligently attempted, though here, as

elsewhere, it has hitherto failed. The best edifice in Philadelphia is the United States Bank, of white marble, in a style of pure Grecian architecture. The Bank of Pennsylvania is also a handsome marble edifice, marble being the chief material of which the city is built.

ROME—The residence of the popes, and for centuries the Capital of Christendom, is also, at present, the Capital of the world of the arts (41° 53′ 45″ N. lat.; 12° 28′ E. lon). It is about 13 miles in circuit, and divided by the Tiber into two parts.

The churches, palaces, villas, squares, streets, fountains, aqueducts, antiquities, ruins,—in short, every thing proclaims ancient majesty and present greatness.

Among the churches, St. Peter's is the most conspicuous, and is, perhaps, the most beautiful building in the world. Michael Angelo, who erected its immense dome, which is 450 feet high to the top of the cross, designed the greatest part. The erection of this edifice, from 1506 to 1614, cost 45,000,000 Roman crowns. The immense canopy of the high altar, supported by four bronze pillars, of 120 feet in heighth, particularly attracts attention.

The two most beautiful churches in Rome, next to St. Peter's, are the St. John's of the Lateran, and the Santa Maria Maggiore. The former is the parochial church of the pope. It contains several pillars of granite, *verde antico*, and gilt bronze; the twelve apostles, by Rusconi and Legros; and the beautiful chapel of Corsini. The nave of the church of Santa Maria Maggiore is supported by 40 Ionic pillars of Grecian marble, which were taken from a temple of Juno Lucina. The other 364 churches of Rome contain monuments of art or antiquity.

Among the palaces, the principal is the Vatican, an immense pile, in which the most valuable monuments of antiquity, and the works of the greatest modern masters, are preserved. Here are the museum Pio-Clementinum, and the celebrated library of the Vatican. The popes have chosen the palace of Monte Cavallo, or the Quirinal palace, with its extensive and beautiful gardens, for their usual residence, on account of its healthy air and fine prospect. Besides these, the following are celebrated: the palace della Cancelleria, the palace de' Conservatori, the palace of St. Mark, the buildings of the academy, &c.

Among the private palaces, the Barberini is the largest. The library contains 60,000 printed books and 9000 manuscripts; a cabinet of medals, bronzes, and precious stones. The Borghese palace, erected by Bramante, is extensive, and in a beautiful style; the colonnade of the court is splendid. The palace Albani, the situation of which is remarkably fine, possesses a valuable library, and a great number of paintings. The palace Altieri, one of the largest in Rome, contains rare manuscripts, medals, paintings, &c., and valuable furniture. In the palace Colonna there is a rich collection of paintings by the first masters. The Aldobrandini palace contains the finest monument of ancient painting—the Aldobrandine Wedding. The great Farnese palace, begun from designs of Sangallo, and completed under the direction of Michael Angelo, is celebrated both for its beauty and its treasures of art. In the palace Spada is the statue of Pompey, at the foot of which Cæsar fell. The palace Costaguti has fine frescoes; Chigi, beautiful architecture; Mattei, numerous statues, reliefs, and ancient inscriptions; the palace of Pamfili has splendid paintings and internal magnificence; Rospigliosi, upon the Quirinal hill, &c. are other fine palaces.

Of ancient monuments, the following yet remain: the Pantheon, the Coliseum, the column of Trajan, that of Antonine, the amphitheatre of Vespasian; the mausoleum of Augustus, the mausoleum of Adrian (now the fortress of St. Angelo); the triumphal arches of Severus, Titus, Constantine, Janus, Nero, and Drusus; the ruins of the temple of Jupiter Stator, of Jupiter Tonans, of Concordia, of Pax, of Antoninus and Faustina, of the Sun and Moon, of Romulus, of Romulus and Remus, of Pallas, of Fortuna Virilis, of Fortuna Muliebris, of Virtue, of Bacchus, of Vesta, of Minerva Medica, and of Venus and Cupid; the remains of the baths of Dioclesian, of Caracalla and Titus, &c.; the ruins of the theatre of Pompey, and those of the theatre of Marcellus; the ruins of the old forum; the remains of the old bridges; the circus Maximus; the circus of Caracalla; the house of Cicero; the Curia Hostilia; the trophies of Marius; the portico of Philip and Octavius; the country-house and tower of Mæcenas; the Claudian aqueduct; the monuments of the family of Aruns, of the Scipios, of Metella (called Capo di Bove); the prison of Jugurtha; the monument of Caius Cestius, which is entirely uninjured, in form of a pyramid, near which the Protestants are buried; the Cloaca Maxima, built by Tarquin, &c.

Bramante, in 1513, designed and began the erection of St. Peter's at Rome, continued by Rafaelle the painter, Peruzzi, San Gallo, Michael Angelo, Carlo Maderno, and Bernini.

STOCKHOLM is finely situated, at the junction of the lake of Malar with the sea. It stands partly on some small islands, and two peninsulas, presenting a view as beautiful and diversified as imagination can conceive. From one point of view it seems a Cyclopean heap of noble structures; palaces and churches piled one above another, and the whole floating. When the lake and sea are frozen, they are covered with sledges of all kinds. Except the great square of Norden Malm, the streets, though of considerable length, are neither broad nor handsome. There is no foot-pavement; the houses are lofty, all white-washed, but the shops are extremely poor. The different families reside in separate floors, or stories, one above another. The royal palace, finish-

ed by Gustavus III, may vie with any structure of the kind in Europe. It is in the Grecian style, quadrangular, 4 stories high, faced with stone-coloured cement.

STUTGARD.—This capital is situated on an extensive plain, 700 feet above the level of the sea, and surrounded on three sides by mountains. It is described as large and dull; but the streets are broad and well-paved, especially the principal one, called the Königstrasse. In its 9 squares and 87 streets there are a number of handsome houses, and the new royal palace is elegant; but there are no monuments of antiquity, no objects calling up any grand historical recollections. There is, however, a library of 200,000 volumes, including 12,000 bibles, and a celebrated gymnasium, attended by 545 scholars.

TEHERAN, the modern capital of Persia, is situated at the northern extremity of Irak Proper, at the foot of the loftiest mountains of Elburg. The two last sovereigns have made it their residence, in consequence of its vicinity to the Russian frontier. It is four miles in circumference, strongly fortified, and rather a camp than a city. It has no grand edifices, except the Ark, combining the character of a palace and of a citadel. Adjacent to Teheran are the remnants of the ancient Rhaig, mentioned as one spot to which the Jews were conveyed after the Babylonish captivity. The remains are of sunburnt brick, and the whole surface, for three miles in every direction, is marked by hollows, mounds, mouldering towers, tombs, &c.

VIENNA.—This great and ancient Capital of Germany, is seated on the southern bank of the Danube, not more than 20 miles from the frontier of Hungary. The original city, surrounded by its once formidable walls, does not exceed a sixth of the space covered by the 34 suburbs, which stretch in an almost interminable extent, but are all surrounded by a brick wall, serving for purposes of taxation and police. The body of the place displays a sober and solid stateliness without gloom. The houses are massive and lofty, and divided among a number of families, with a common staircase. There are, on an average, 38 men in every house in Vienna, and there is one which contains 400. The city is rendered very handsome by the great number of mansions, (justly entitled to the name of palaces) which are held by the high Austrian and Hungarian nobles. There are few very prominent single edifices. Even the original palace of the House of Hapsburg is a collection of dissimilar and ill-assorted masses, added to each other as convenience dictated. That of Belvidere is more attractive, from its rich collections; and the rural palace of Schönbrunn, from its fine gardens. The cathedral of St. Stephen is the largest church in Germany, and unites all that is lofty, imposing and sublime in Gothic architecture. A colossal and equestrian monument of Joseph II. adorns the square which bears that emperor's name. Vienna has a number of other churches that are highly ornamental, particularly that of St. Lorenzo, a Gothic structure of great elegance.

Vienna is not a literary city, and is, perhaps, the largest that exists without an academy, either of science or belles lettres. Yet, there are few that contain more extensive collections of books, paintings, and objects of natural history, both in the royal palaces, and the houses of the nobles. The censorship of the press is maintained with the utmost rigour; and the great object of the court seems to be, that nothing shall appear which can, in the smallest degree, reflect upon the imperial house or government.

The free towns in Germany, governed by oligarchies, are Hamburgh, Bremen, Frankfort, and Lubeck, with territories of from 100 to 130 square miles. Hamburgh contains 150,000 inhabitants, and the others 40 to 50,000 each.

WASHINGTON.—The city of Washington has been built by the American government as its own chief seat and also in the expectation of its becoming the greatest and most splendid metropolis in the New World. The situation is fine, on a somewhat elevated ground, at an angle formed by the two branches of the Potowmac. The plan is represented as almost unrivalled for regularity and beauty, forming a parallelogram of four miles by two and a half. The greater number of streets meet at right angles; but the main avenues cross these diagonally, while the public buildings are placed in situations which it is expected will give them the happiest effect. In the Capitol, or house for the assembling of the Congress, no cost has been spared to produce the utmost possible magnificence. 900 marble columns have been imported, and the talents of four artists have been employed upon it. The principal public buildings and institutions in the city, are the Capitol and the President's house, of stone; the buildings for the state, treasury, war and navy departments, and the general post-office, all large brick edifices. It has, also, a navy-yard, and extensive barracks.

On the 24th of August, 1814, this city was taken by the British, who burnt the public edifices, all of which are now rebuilt or repaired, except the Capitol, which is not yet finished.

The immense extent of America implies many future capitals. Thus, in the United States, there are NEW YORK, PHILADELPHIA, BOSTON, NEW ORLEANS, as future capitals of vast regions, equal in extent to many kingdoms of the old Continent.

MEXICO and GUATAMALA are others, which the year 2000 will, no doubt, regard with wonder; and Bogata, Lima, Rio Janeiro, Buenos Ayres, &c. &c. will, in a future epoch, vie with any of the old cities of Asia, Europe, and Africa, now treated as splendid and unequalled capitals.

POPULATION, INDUSTRY, & POOR.

In the article 'GEOGRAPHY,' we have given Balbi's numbers of Nations, with some corrections. To this we must refer the enquirer, and shall, in this article, confine our details chiefly to what regards the British Islands. But, as we may suppose there will be another official return in 1841, we have avoided certain tabular details, which will be given as soon as promulgated.

Population of Great Britain as it stood in 1841.

Population, 1841.	Males.	Females.
England..14,995,508	7,321,875	7,673,633
Wales.... 911,321	447,533	463,788
Scotland.. 2,628,957	1,246,427	1,382,530
Tot. Gt. Br. 18,535,786	9,015,835	9,519,951

Population of Ireland as it stood in 1833.

Total (Males & Females) 7,767,401

Taking the small islands as 103,710, the gross population of the United Kingdom, in 1831, was 24,410,429!

In 1834, the population of Ireland was returned 7,943,940; of whom 6,427,712 were Catholics, 852,064 Established Church and Methodists, 642,356 Presbyterians, and 21,808 Baptists, &c. There were 1338 churches, and 196 chapels; Catholic 2105, Presbyterian, &c. 955. The parishes were 2405. 157 Benefices had no duty; in 41, no members of establishment.

The first enumeration of Eng. and Wales, in 1801, ought, instead of 10·9 millions, to have been 12¼; the next, instead of 12¼, should have been 13¾; the next, of 14·4, should be 15·5; and the last, instead of 16¼, should have been 16·8 millions.

The economists fondly call the population in 1700 but 5 millions; and, in 1800, 11 millions; so that the number of Elizabeth's subjects could, on this theory, have been but 2¼ millions; of Henry VII., but 1½; of Henry IV., in 1400, but 625,000; and, in the age of Alfred, there could not have been above 20,000 in England and Wales; while, on the arrival of Hengist, the Frieslander, there could not have been 1000 in England and Wales; yet, how many unprincipled theories have been founded on the absurd assumption, that we have more than doubled in 100 years!

The Families in the three kingdoms were, in 1831:—

ENGLAND, 2,745,336 of 4·7 to a family; of whom, 761,348 were engaged in Agriculture; 141,460 as occupiers, who employed labourers, *i. e.* farmers; and 94,883 as small occupiers, who employed no labourers. There were, also, 744,407 labourers, at 3 to every 100 acres. The average of land of each farm was 225 to the kingdom, but in some counties it exceeded 300. On the average, 21 labourers on every four farms.

1,118,295 families were engaged in trade, manufactures, or handicrafts.

And the other 801,076 were nobility, gentry, professional, or without employment.

WALES had 166,538 families, of 6·094 to a family; of whom, 73,195 were agricultural, and 44,702 manufacturing and trading; 48,641 unemployed, or professional.

SCOTLAND, 502,301 families, of 4·708 to a family; of whom, 126,591 were agricultural, 207,259 traders or manufacturers, and 168,451 unemployed or professional.

IRELAND, 1,546,873 families; of whom, half are unemployed, 1-fifth agricultural, 1-fifth in trade and commerce, and 1-tenth as artizans.

GUERNSEY, JERSEY, &c. contained 62,710 inhabitants, and the ISLE of MAN 41,000.

The Isle of Wight contained 35,363; the Orkneys, 29,392; the Shetlands, 29,847; Skye, 22,736; Lewis, 14,541; Islay, 14,992; and Harries, 3900; included in counties.

The British, in the Colonies, &c. are full two millions.

In House population, Plymouth is highest, 9½ to a house; and Burslem, in the Potteries, the lowest, but 4⅘th. The mean of all the towns is 6⅐th.

The population of all the towns, containing above 1200 houses, is rather above 4 millions; and, in 1811, it was but 2⅓ds.

By Domesday-Book, it is estimated there were about 400 000 families in England; and, adding 125,000 for Wales, the population must have been full 2,750,000; and, taking them now at 13½ millions, this gives a quintuple number in 750 years, or a doubling in 300 years; or, adding 2 millions for emigrations, in about 260 years, the ratio fixed by Petty, Young, and others.

The population of Europe, per square mile, is, Sweden, 14; Turkey, 36; Poland, 52; Spain, 63; Germany, 127; the United Kingdom, 152; France, 154; Italy, 172; and Holland, 224.

London, Paris, Petersburgh, Naples, and Vienna, are, in order, the most populous cities in Europe.

	Houses.	*Population.*
London..........	174,000	1,400,000
Paris............	45,000	850,000
Petersburgh.... ..	9,000	430,000
Naples	40,000	360,000
Vienna	7,500	300,000

As far as enumerations are to be relied on, Prussia increases, annually, 1 in 56; Austria, 1 in 64, Russia, 1 in 69; Denmark, 1 in 70; the United Kingdom, 1 in 75; Germany, 1 in 74; France, 1 in 109; Italy, 1 in 97; Spain, 1 in 120; and Portugal, 1 in 90. An increase essential to the increase of the arts of life by increase of civilization.

If modern enumerations give a higher proportion, it is because each enumeration finds out numbers not included in previous enumerations—mankind having a religious prejudice against being numbered, and many being afraid of fiscal and military designs.

The population of England, in the age of Alfred, is partly determined by the hundreds,

which were each supposed to contain 120 families—650 souls. Thus, Kent had 62; Sussex, 64; Norfolk, 33; Suffolk, 21; Essex, 20; Lancashire, 6; Cheshire, 7; Cornwall, 9; Northumberland, 7; and Cumberland, 5.

The poll-tax in England and Wales, in 1377, made returns of the population paying 2,300,000; and, if we suppose the children and paupers to be two millions, the population of England and Wales would, at that time, be 4,300,000. In 1690, the hearth-tax gave a population of about 6 millions, and the returns of 1821 gave 12 millions; consequently, in a period of 444 years, the numbers appear to have nearly trebled.

Mortality and Longevity.

The annual mortality in different countries in Europe varies from 1 in 28; in the Roman States, to 1 in 50; and 51 in Great Britain. In Germany, &c. it is 1 in 45; and, in France, 1 in 40. In the Eastern Archipelago, and in the West, it is 1 in 27; and, at Bombay, 1 in 20. Among Europeans, at Batavia, it is 1 in 11; at Bombay, 1 in 19; and West Indies, 1 in 22. Natives of the same places are 1 in 35 to 1 in 40.

In Belgium, Quetelet estimates, that, of 10,000 births, 105 reach to 96 years · 10 to 100; and 1 to 103.

Easton collected 1712 instances of longevity above 100; and made up 277 from 110 to 120; 84 from 120 to 130; 26 from 130 to 140; 7 from 140 to 150; and 8 from 150 to 190. Some, however, were Saints, and very questionable.

Larry makes 35 above 100 in Cairo.

Several instances from 120 to 143 are recorded in the United States.

Between 1821 and 1831, there were registered, in England and Wales, 1,052,095 marriages; 3,747,493 births, (75,000 more males), and 2,462,907 burials. There were also 3,640 unentered marriages, 172,640 births, and 94,800 burials. Total, 1,055,735 marriages, 3,920,133 births, 2,457,707 burials.

There were, of the preceding, 19,976 illegitimate births.

The burials, subtracted from the births, afford evidence of increase of only 1,462,326; and the difference of the enumerations was 1,915,128.

From 1658 to 1726, the burials in London varied from 18,000 to 24, 25, 28, and even 29,000, being, in 1699, 20,795, and 1691, 22,691; though the population, in 1700, was but 674,000; and, in 1830, 1,400,000.

Of every 10,000 males and females, in England, there are living:—

	Age.	Males.	Females.
Under	5	1538	1444
	5 to 10	1343	1268
	10 to 20	2157	2051
	20 to 30	1470	1684
	30 to 40	1155	1210
	40 to 50	940	933
	50 to 60	666	653
	60 to 70	448	458
	70 to 80	222	228
	80 and upwards	61	70

Of 10,000 males born at the same time, there would,

At 5, be living	6313
At 10	5876
At 20	5293
At 30	4572
At 40	3951
At 50	3301
At 60	2585
At 70	1673
At 80	660
At 90	75
At 100	3

Of 10,000, males and females, there die under 5 years of age, 3687 males and 3207 females:—

5 to 9	437	and 411
10 to 14	262	269
15 to 19	318	368
20 to 29	724	840
30 to 39	621	725
40 to 49	650	670
50 to 59	716	684
60 to 69	912	923
70 to 79	1013	1086
80 to 89	585	701
90 to 99	72	110
100 to	3	6
	10,000	10,000

The burials and baptisms, every 20th year, have been as under in London:—

	Burials.	*Baptisms.*
1726	27,310	16,652
1746	28,157	14,557
1766	23,911	16,257
1786	20,454	18,119
1806	17,938	20,380
1826	20,758	22,244
1830	21,645	26,743
1837	21,063	35,706

Of 25,337 burials in London, in 1831, 2677 died of old age, and 7144 under two years, and 10,459 under five. Of small-pox 563, measles 750; 485 of apoplexy, 4807 of consumption, 1061 of asthma, 246 palsy, 226 insane, and 207 of mortification, grief 25, dropsy 1108, inflammation 2812.

Of 25,262 burials in 1731, 1675 died of old age, 10,287 under two years, small-pox 2640, measles 102, apoplexy 237, consumption 3425, asthma 469, palsy 38, insane 21, mortification 183, grief 14, dropsy 1047, inflammation 12.

In 1681, of 23,971 burials, 5571 were under two years, 1301 of old age, small-pox 2982, measles 121, apoplexy 94, palsy 20, consumption 3781, insane 16, grief 11, dropsy 958.

In 1603, 36,269 died in London of the plague; in 1625, 35,416; in 1636, 10,400; and, in 1665, 68,596, chiefly in August and September; in the latter year, 7165 died in the week ending Sept. 19. The first two died in April, nearly 300 per week dying in Dec., and 1998 in 1666.

It appears by Marshall's abstracts, that, in 1681, the population of London was but 130,178, and in 1700 but 200,300. The deaths in 1631 as 1 to 21; in 1700 as 1 to 24; in 1750 as 1 to 26; in 1820 as 1 to 52.

Plagues and contagious diseases have been fatal to London.

In 1348	....	100,000 died.
1407	....	30,000
1472	....	40,000
1500	....	20,000
1518	....	23 000
1528	....	25,000
1603	....	36,000
1625	....	35,416
1665	....	68,596

The marriages have been to the births as 1 to 3·72, *i. e.* there are nearly 15 children to every 4 marriages, but latterly it is 3 8, or 19 to 5.

In the 18 years, from 1813 to 1830, there were 3,938,496 registered burials in England and Wales, 1,996,195 males, and 1,942,301 females.

Of the males, 436,946 died under 1 year, and only 341,137 females.

Under 5 years, the males were 736,039, and the females only 622,903.

From 5 to 9, the numbers were 87,263 males, and 79,732 females.

From 10 to 14, they were 52,324, and 59,155.

From 15 to 19, the excess was reversed, or 63,405 and 71,535.

And, from 20 to 29, the males were but 144,586, and the females 163,140.

So, from 30 to 39, 133,996, and 140,848; and, from 40 to 49, 129,675 and 130,139.

From 50 to 59, it was 142,843, and 132,918; and from 60 to 69, 182,097 and 179,251.

But, from 70 to 79, again reversed, and 202,208 to 211,028.

From 80 to 89, 116,726 and 136,085; and, from 90 to 99, 14,486 and 21,304. Above 100, 637 and 1263; but 5 men were above 117, and only 1 woman.

So that, under 15, females are more tenacious of life than males; from 15 to 50, males more than females; and, above 50, females more than males.

1900 of both lived above 100, or 1 in 2073.
290,501 above 80, or 1 in 13 56.
703,737 above 70, or 1 in 5·6
1,064,995 above 60, or 1 in 3·7.
1,340,756 above 50, or 1 in 3 nearly.
1,600,570 above 40, or 1 in 2·462.
1,865,414 lived above 30, or 1 in 2 112.
2,173,140 above 20, or 1 in 1·988.
2,308,080 above 15, or 1 in 1 707.
2,412,559 above 10, or 1 in 1 633.
2,579,554 above 5, or 1 in 1 527.

The greatest mortality, in 10 years, was 778,083; after the first year, 266,443; after the second, 154,014; after the third, 94,663 between the third and fourth; and 48,194 in the fifth. The lowest, under 86, was 19,796 in the twelfth year, and 19,949 in the thirteenth. At 22 it rose to 33,785, and 33,513 at 40. At 60 to 43,273, at 66 to 40,492, and at 70 to 53,953. But, the excess at all the even numbers seems to have arisen from uncertainty.

One half die before 26, and two-thirds before 50.

4·2 births are reckoned to every marriage, in a system of early marriages.

The marriages, in 1770, were 62,693, and in 1830, 107,719. The proportions of marriages to returned population, in 1800, were as 123 to 1; in 1810, as 121 to 1 · in 1820, as 127 to 1; in 1830, as 128 to 1; so, that, marriages are not on the increase.

The baptisms were a 36th o the population in 1800, and a 34th in 1830

The burials were 1 in 48 in 1800, and 1 in 51 in 1830.

The mortality in counties in England, from varied climate or diet, is greatest in London, where, on every 100 males of different ages, 3 03 die per annum, and females 2·53 Hertford and Monmouth are the most healthy, 1 78 and 1 79. Surrey, owing to the borough, is 2·81, and Lancashire 2 4, and for infants 6·56. Surrey and Middlesex, for infants, average 8. Wales and Monmouth are but 4 for infants.

Six large towns in England give a loss of infants, under 5, of 8·63 per cent.; while London is but 8 27; and, in the towns, the mean deaths are 2·95, and in London 2·84.

The present deaths of infants, under 5, is taken at 9·78 per cent. on males, and 8 52 on females.

The annual mortality of troops, in the West Indies, is from 23 to 6 per cent. In the East Indies, from 9 to 3 per cent.

The returns give 3 females in 100 more than males, for the United Kingdom. France and Spain make the same difference in the sexes, but the United States' Returns make 2½ per cent. more males than females.

The males above 20 years are, by the returns, made to be 239 per 1000 of the whole population, or 1 in 4.

The returns of 1831 make the births 1 in 34½, and the deaths but 1 in 58½. In France, in 1834, the births were 1 in 33½, and the deaths 1 in 41. London, in 1833, the ratio of deaths was 1 in 46. Middlesex, 1 in 45.

The improvements in food, medicine, clothing, and the cow-pox, have so raised the expectations of life, that in 1695 it was, at 20 years of age, taken at 29 34; but, on two authorities, is now taken at 38·39 and at 39 65, and at 60 years of age was 11 65, but now 14 39 and 14 2.

Women, married at 25, live 4 years longer than unmarried ones. 72 married women live to 45, for 52 unmarried. Among married men, 41 attain 45, for 18 unmarried. At 60, there are 48 married men for 11 unmarried. At 80, the numbers are 9 married for 3 unmarried.

The result of the recent investigation of mortality may be concisely stated as follows:—Of children born there die, in Leeds, 53 per cent. under five years of age, and 62 per cent. under twenty years of age; in Bradford, 47 per cent. under five, and 59 per cent. under twenty years of age; in Beeston, 39 per cent. under five, and 52 per cent. under twenty years of age; in Holbeck, 50 per cent. under five, and 62 per cent. under twenty years of age; in Norwich, 42 per cent. under five, and 50 per cent. under twenty years of age, in Bolton, 49 per cent. under five, and 61 per cent.

under twenty years of age; in Wigan, 48 per cent. under five, and 59 per cent. under twenty years of age; in London, 38 per cent. under five, and 46 per cent. under twenty years of age; in Rutland, 29 per cent. under five, and 37½ per cent. under twenty years of age, &c. It further appears, that in Essex, Rutland, and the metropolis, persons live to an advanced age in a greater extent than others.

Of 10,000 born at Carlisle, taken as a standard, 8461 are alive in one year; 7779 in two years; 6676, or two-thirds, in six years; 6460 in ten years; 6047 in twenty-one years. 5009 in forty-one years; 4000 in fifty-six years; 3395, or one-third, in 62 years; 1997, or one-fifth, in seventy-three years; 1000, or one tenth, in seventy-nine and a half years; 105 at ninety-one years; 40 at ninety-four years; 9 at one hundred years; and 1 at one hundred and four years.

The probability of life, at any age, is the number of years which intervenes before the number of living is half that of the age given. At 25, the expectation of life is 38·52 years, and, at 65, is 12½ years. At 25, an annuity of 1*l.*, at 4 per cent., is worth 17·634*l.*, and at 65, worth 8·751*l.*

At 60, in ancient Italy, the expectation of life was 5 years; in modern France, 13·11; in England, 14·4; in Geneva, 11·5; and in England, by Finlayson's Tables, 14·39 for men, and 17·32 for women.

In Cornwall, 84 females die per annum, out of 5000. In Gloucester, 89. In Wales, 90. In Somerset, 94. In Norfolk, 99. In Northampton, 104. Nottingham, 109. Lancashire, 114. Surrey and Middlesex, 125.

Taking the mean number of the human race at 700 millions, and the mean term of life at 30 years, the number of 700 millions are constantly renewed and exhausted in 30 years, so that $\frac{700}{30}$, or 23,333,333, are begotten, born, and die, every year; 64,000 every day; 2666 every hour, and nearly 45 in every successive minute.

The illegitimate children, in 1830, were 20,039 in England and Wales; being 1-19th of the births. In the manufacturing counties, as Lancashire, 2930, (1 to 13); the West Riding, 1534; Stafford, 736; and Warwick, 425; Cheshire 588, same as Devon; Middlesex, only 905; Norfolk, 648. Glamorgan, 275. Many, of course, are concealed. In Hereford, it is 1 in 13 births; in Pembroke, 1 in 8; and, in Radnor, 1 in 7.

Principles of Population.

Every generation is a direct product of the *marriages* in the preceding generation; that is, the number of the existing generation, of all ages, is the product of the number of all the marriages in the past generation, by the average number of children 3·7 or 3·8, produced by a marriage. Therefore, the number of marriages in any year, by the ratio of children, is the number for every year of the next generation, and this annual number, into the years in a generation, is the whole population of the next generation.

The length of a generation is now determined to be 41 years from the actual enumeration, for it has been variously estimated. The French used to call it 28·75, and they now extend it to 32·2, by increased public health, vaccination, &c.

The population of England and Wales, in the mean period of the generation before 1831, was about 12 millions, including deficient returns; and, in 1831, was 13,897,000, the increase being about 1·9 million.

Then the mean number of marriages per annum was 86,000, which, by 3·7, is 318,200 births per annum; to which, adding 21,800 illegitimate, we get 340,000 births per annum, and this, in 13,900,000, the presumed population, gives 41 years nearly, for the mean term of life, or a generation, which accords with the Carlisle tables.—*Phillips.*

Knowing the population at any time, the mean number of marriages, and the average children to a marriage, we may anticipate the future population. In England and Wales the marriages have been a 1-139th of the population per annum: but, if the marriages had been 79,750 instead of 86,000, or the 1-152d instead of the 1-139th, the population would have been *stationary.* For 152 is the product of 41 into 3·7; consequently, if the marriages were less than the 1-152d of the existing numbers, the population would *decrease.* An increase is, however, necessary, to guard against contingencies, for, as the 41 varies, the ratio of marriages must be increased or decreased to preserve the same number.

Whatever be the law of *births*, must within the generation be the law of *deaths.*

Taking the mean population at 12½ millions, and the married of both sexes at 2,111,470, the marriages include one-sixth. So that five-sixths do not marry; and, of these, nearly three-sixths die under 20; so that two-sixths never marry, *i. e.* two do not marry for one that does marry.

The marriages in England and Wales were—

In 1800	69,851	In 1829	96,833
In 1810	84,470	In 1831	105,573

The Baptisms—

In 1800	254,870	In 1820	343,660
In 1810	298,853	In 1831	392,013

The Burials—

In 1800	208,063	In 1820	208,349
In 1810	208,184	In 1831	245,770

The twin births are 1 to 65. The male births to females 96 to 95.

The fecundity of marriages in England, at this time, is 3·77. In Prussia, 4·23. In France, 3·79. In Belgium, 4·72. It varies with the age. It was 4·5 in England.

There is a marriage in England for every 128 of population. In Prussia, for 102. In France, for 131·4, and in Belgium for 144.

Nature variously restrains numbers, thus: 2-5ths of all females die before 16, and from 16 to 46 there are only 1-5th, and 2-5ths above 46. That is, there are 1,200,000 marriageable, on a gross population of 12 millions.

But, as 2-3ds never marry, from various

causes, so the number of marriages is limited to 400,000 of those who, in every 4 or 5 years, live beyond the age of puberty. This number, on the whole population of England and Wales, taking 41 as a generation, would be about 170.000; but the 4·10ths who die before 16 reduce the number to 102,000.

The number of children per marriage, by recent returns, is found to be 3·8, and this into 41 gives the 155·8 for the ratio of equality: so that, on 14 millions, 90.000 marriages per annum would just preserve the numbers; but, between 1821 and 1831, they actually averaged 105.209 per annum, which by 3·8 is 401,177 per annum, and this by 41 will raise the population of England and Wales in 1850 to 16.448.257. Such is the law, and its simplicity! The 155·8 of marriage is the zero of population, and all proportions higher give increases, and all lower decrease as the numbers.—*Phillips.*

Human population depends on several female circumstances, proper to be considered. 1. The ova, 23 or 24 in number, limits the procreative period to that number of years at most. 2. The menstrual period is a further limitation in late marriages. 3. These combined circumstances and sundry accidents, therefore, limit the progeny per marriage, as matter of fact, to an average of 3·8, or 3·7, about 11 to every 3 marriages. Of course, these determined periods are quite independent of duration of life in either sex; and, while thus fixed by nature, population could not vary, whether mean longevity were 40 or 100. All past theories on this subject are essentially false and absurd. There is, also, a further limitation in the equality of the sexes, determined by the natural chance that every birth is either male or female.—*Phillips.*

Owing to each of 2 parents having 2 parents, these 2, and so on, every living person is descended from millions in past generations, and every parent must be the ancestor of millions in future generations. The numbers increase as the power of 2, taken retrospectively or prospectively. Taking 3 successions in a century, it is in the first *century* 2, 4, 8. In the second, 16, 32, 64; in the third, 128, 256, 512; in the fourth, 1024, 2048, 4096. In the fifth, 8192, 16,384, 32,768; that is, a man born in 1800, had 32,768 ancestors living in 1300. In 1000 years, it would have been 1074 millions; so that the human race are truly one family.

The mean term of life seems to have increased within half a century from 33 to 41, serving, *at present*, to diminish the burials. But the limit lies in the unchanged term of female parturition, from 18 to 45, and the number of births to a marriage.

Thus, if, owing to any mortality, the mean term were decreased from 41 to 35, then 3·7 into 35 gives 129·5, and a 129·5th of the population must marry, to maintain the numbers in the next generation.

In regard to the physical bulk of the contemporary population, since 9 middle-sized persons can stand within a square yard, or a string 4 yards long will encompass them, so *a single square mile* of 3,097,600 square yards, 27.878.400 feet, would hold a greater number than live in the United Kingdom! And if there are 36 times this number on the globe, the whole would occupy an area but 6 miles each way! Then, as there are 50 millions of square miles of land, or 8,333,333 times 6 miles, so 200 generations of men reduced to dust and pressed to the density of soil, would be but 18 inches of coating to the 36 miles, and, of course, but the 450,000th of an inch scattered over the whole surface. But, if a man's body is renewed 50 times during life, even then it would form soil but the 9000th of an inch; so that the remnant of the species *Homo* have afforded in reality but little manure to the Earth's surface.

If it be asked whether the human race, and the present system of animal economy, will endure as long as the globe and its solar re-actions, we have no data but references to the past. We see races, kinds, and forms, once covering the surface, now no more. We find ages of shelly beings, of reptiles, of pachaderma, of gigantic creatures, &c. &c. We now find races re-acting on an atmosphere as 79 to 21, and sustained by water 11 to 79. Will these proportions last? Does not oxygen increase and hasten life, and does not water dessicate? We see the human race flowing from the exhausted East to the West, portentous of results when the tour is completed. We see species disappear, and behold every proof that the circle of existence resembles an endless spiral, changing forms in fitness at every deflection of its solemn course!

Wallace, in 1760, in a work on the numbers of mankind, developed the principle of increase of numbers, being in higher ratio than increase of food, which was adopted and copied by Malthus. While, however, the surface of the earth is so inadequately inhabited, and there are 50,000 millions of acres of land, 40,000 millions of which are capable of production, all such speculations are as idle and contemptible as the reveries of the monks in the age of St. Jerome.

Foreign Determinations.

A generation, or age, is taken, by French economists, to be 33⅓ years, or 3 to a century, and the determination is made on registers of joint ages at marriage, and of mean age at the birth of children.

In the Hotel Dieu, at Paris, a fifth of the patients die, a tenth in the London hospitals, and a fifteenth in country ones.

The deaths in France, in 1820, were 770,706: in Great Britain, 208.314; and of births 958,933 to 343,360; indicating a proportion of 3½ to 1.

In France, 10.000 born are reduced to 5000 at 25½, to 2813 at 41, to 353 at 69, to 51 at 90, and 1½ at 100.

49 men and 36 women, out of 10,000 of each, live to 90 in the cities of Belgium, and 67 men and 71 women in the country where the women are slaves. In the cities, but 1 woman attains 100, and in the country 1 man and 1 woman. 5000 men attain 20, and

5000 women 28; but, in the country, 5000 men attain 23, and 5000 women, for the same reason, but 27. In the first 5 years, the 20,000 are reduced to 12,500, and at 63, the 12,500 is 5000; so that the deaths in the 5 years is equal to those in the next following 50 years. At 76, only 1 in 10 survives.

In Belgium, the deaths in January to those in July are as 1212 to 809.

328 clergy attain 63 to 72, and 257 from 73 to 82, out of 1000; and only 228 and 141 medical men.

The Pays Bas is the most populous of all countries, having 1829 inhabitants to a square league, 25 to a degree. Lombardy, 1711; Wurtemberg, 1502; and England, 1457. Spain and Turkey have but 641 and 324.

In the Pays Bas, of 1000 men and women, two-thirds of each are unmarried. The widows are double the widowers.

The population of Belgium is 4,165,953, of whom ⅕ are in towns. The births are 143,000, the marriages 32,680, and deaths 101,200. 23 is the mean period of life in males, and 27 of females. 100,000 born, are 70,500 in 2 years, 50,000 at 25, 40,000 at 41, 25,000 at 62, 17,000 at 70, 5000 at 81, 500 at 91, and 10 at 100.

In Belgium, the mean of men's ages in towns is 29·24, and in country 31·97; and, of women's, 33·28 and 32·95.

The population of Italy, in 1837, was 21½ millions. 7¾ Naples; Church 2½; Sardinia 4½; Lombardy 4½; Tuscany 1½; Parma, &c. 1.

Switzerland 2,179,632.

In Italy, of 100 infants, born in December, January, and February, 66 die in the first month, 15 more in the course of the year, and 19 survive; of 100 born in spring, 48 survive the first year; of 100 born in summer, 83 survive the first year; of 100 born in autumn, 58 survive the same period.

In 1834, the male births in Prussia were 283,495, and the female 269,787. The deaths in the same year were 218,108 males, and 205,081 females. The total population was 13,256,867 as the mean of 1832, 3, and 4. In 10 years it increased 1½ million. In 44 cases there were 4 at a birth in 10 years; and, in 2000, 3 at a birth. Of the deaths, 1,915,000 died under 3 years, and 26,576 above 90; 1 in 68 of small-pox. The suicides in 15 years were 16,680, of whom 3000 were females. The fatal accidents 73,686, of whom 18,000 were females.

1 of every 500 is deaf and dumb in Switzerland; 1 in 1500, in other countries of Europe; 1 in 2000 in the United States.

In Sweden, of 200,000 males, 200 live above 90; and, of the same, females 450. Half die between 35 and 40. Sweden increases 8 per cent. in 10 years, other countries increase from 8 to 12 per cent.

In 1463, Russia had but 6 millions of inhabitants, extending only to 18,500 square German miles. In 1584, its population was double, and its extent 6 times more. Peter the Great again doubled its size, and included 20 millions of inhabitants. At the death of Catherine, in 1796, it extended over 331,810 square German miles, and contained 33 millions; Alexander added, and under Nicholas it consists of 370,571 miles, with 50 millions of inhabitants.

Poland contains 4 millions, of whom, above 3 are rural, and 869,000 in 453 towns.

The slaves in Russia, Servia, &c. are estimated at 45 millions.

The 15 provinces of China appear to contain 368 millions of inhabitants, at 268 to the square mile, of which there are 1,372,450. Some provinces give 700, 500, 400, and 300, to the mile; 1 as low as 40, and others under 200. The most populous are the eastern provinces. Tartary, &c. add 2 millions more.

Men vary on the average, in *length*, from 496 at birth, 1000 at 5, 1500 at 15, 1722 from 20 to 30; and then shorten to 1713 at 40, 1674 at 50, 1639 at 60, and 1613 at 80. In *weight*, they vary from 32 at birth to 100 at 1, 150 at 4, 290 at 7, 310 at 12, 574 at 17, 650 at 20, 690 from 30 to 40, and then grow lighter, as 655 at 60, 630 at 70, and 610 at 80.

Women are at birth only 483 *long*, 1000 at 7, 1500 at 16, 1580 at 30, and then decline to 1555 at 40, 1516 at 60, and 1506 at 80. In *weight*, at birth 29, 93 at 1, 305 at 12, 491 at 17, 550 at 25, 566 at 40, 585 at 50; then lighter, as 567 at 60, 537 at 70, and 515 at 80.

At 80, both sexes are the same heighth as at 16; and the same weight at 80 and 16.

Boys at 18, who work in factories, are to other boys, in weight, as 48 to 57; and, in girls, the differences are as 48 to 55. In truth, factories lower the human standard, both in weight, heighth, and longevity.

The mean weight of the human skeleton is 17 lbs., of the male 17·5 lbs., and the female 15·8 lbs.

The force of a man, at 20, is 31·4 lbs. with both hands; with the reins a third; 15 lbs. with the right hand, and 14½ lbs. with the left. Woman but 16 lbs., 7½, and 6¾ lbs. The greatest power of man is at 30 lbs. or about 33 lbs.

Ratio of Diseases

In the Seven London Hospitals:—

HOSPITALS.	Out-patients in One Year.	In-patients in One Year.	Ave. num. of In-patients.	Annual Deaths.
Bartholomew's ..	21,403	5,164	483	392
St. Thomas's	25,430	3,000	398	261
Guy's	50,000	3,395	480	300
Westminster	3,885	796	100	..
Middlesex	4,426	1,732	180	165
London	7,125	2,517	300	260
St. George's	4,588	2,133	250	227
Total......	116,857	18,740	2191	1605

In 1000, only 228 medical men live from 63 to 72, and 328 theologians; from 73 to 82, but 141 and 2 ; and from 83 to 93, 30 and 70. Till 62, the medical men are more than the clerical.

In professions, of those who attain the age of 66, there are found to be

43 Theologians. 32 Clerks, &c.
40 Agriculturalists. 29 Advocates.
35 Men in office. 28 Artists.
32 Military. 27 Professors.
24 Medical practitioners.

Proportion of Deaths and Sickness, at different Ages, among Members of English Benefit Societies:—

Between Ages.	Annual Deaths Per Cent.	Six Weeks in a Year.
20 to 30	95	·806
30 .. 40	1·45	·953
40 .. 50	1·85	1·339
50 .. 60	2·98	2·206
60 .. 70	4·92	5·89
70 .. 80	9·80	17·
80 .. 90	....	21·
90 .. 100	....	35·

From the books of Benefit Societies, it appears that in the middle ages, from 20 to 60, that for every death there are twice as many sick of similar ages as the ratio of mortality, *i. e.* if any man die at 55, in any Society of 100, the ratio is 2·34, and this by 2 gives 4·68.

So also, taking the mean of all ages in England as 2·0885 per cent., 4·177 is its double, and for every death in the 14 millions 4·177 is sick, *i. e.* 584,780.

In 21 provincial hospitals, the total expences of the 21 are 44,084*l.* for food, fire, &c.; and, for drugs, &c. 5,216*l.* The mean annual expences, per patient, are 23*l.* 5*s.*

It appears, by the registers of benefit societies, that persons, from 20 to 35, average 7 days sickness per annum; from 30 to 50, 9 days; from 50 to 55, 10 days; to 60, 13¼ days; to 65, 21 days; to 70, 39½; and, above 70, 116 days.

A society may give 1*s.* per day after 65, 10*s.* per week in sickness, and 15*l.* at death, if its members, commencing at 15, pay 2*s.* 2½*d.* per week; at 25, 3*s.*; at 33, 4*s.* 4*d.*; and, at 45, 8*s.* 5½*d.*; making 4 per cent. of their money.

At Manchester, three-fourths of the inhabitants are under medical treatment; and there are 430 gin-shops, all crowded on Saturday evenings.

In the cotton factories, 27·8 males per cent. are ill, on the average, 16·43 days; and 41·7 females, on the average, 12·63 days.

From 1771 to 1780, in London, 1-10th died of small-pox; but, in the last 5 years, but 1-40th. Consumption killed a 5th and 4th; but, since 1810, but a 6th. Measles, since 1800, a 37th or 38th; before 80, but a 200th. Apoplexy has doubled in this century, and is now 19 per 1000. Old age has risen from 70 and 80 per 1000, to 112. Suicides are trebled, being 1 in 450.

On 4 millions of burials, England and Wales return 2000 above 100 years of age. Scotland on 2 millions returns 102 above that age; and Ireland on 7½ but 349.

Of 240 Cornish miners, no one had attained the age of 70; only 2 were 65, and 8 of 60. But, in 240 Cornish labourers, there were 16 of 75, 28 at 70, 54 at 65, 79 at 60.

In 2500 labourers, the days of their sickness at 20 averaged 14 days; from 30 to 40, 22·63 days; and from 60 to 70, 29 days. In musters of soldiery, at home, 4 to 5 per cent. are on the sick list; but, at Madras, 10 per ct.

Industry and Employments.

The best returns make it appear, that, in Great Britain, there are about 4 millions of males above 20;—that 187,000 are farmers, who employ 887,000 labourers, and 167,000 are occupiers of some land who do not employ labourers;—that about 405,000 are operatives in manufactories, and 1,200,000 are shop-keepers and handicraft artizans;—that 609,000 are porters and assistants, coachmen, &c.; 236,000 are clerks, &c.; 80,000 are footmen, &c.; and 210,000 are gentlemen, bankers, and professionals.

Ireland has nearly 2 millions, of whom 1½ millions are rural, and 400,000 retail, operative, and handicraft.

In Lincoln, Hampshire, Rutland, Suffolk, Northampton, Essex, and Cambridge, 53 or 54 of every hundred are agricultural. In Lancashire and the West Riding, 70 in every hundred are manufacturing. In Leicestershire, Nottinghamshire, Staffordshire, Middlesex, and Warwickshire, 55 to 60.

In Great Britain, Marshall calculates that the *Coal Districts* of the North employ 53,835 families.

Other *Collieries* about 9600.

Coal and *Iron*, and hard-ware, 106,000 families.

The *Cornish Mines*, 34,742.

Other *Mines* and *Quarries*, 17,182; so that Mining provides for 221,359 families

The *Potteries*	8,015
Woollens, (West)	32,418
Ditto, (Yorkshire)	113,099
Worsted, &c. mid. Coun. ..	60,531
Ditto, Norfolk	23,360
Silk manufactures (1834) ..	25,228
Cotton, all branches	203,443
Linen, &c.	18,000
Salt-Works	5,000

So that the staple manufactures provide for about 3 millions of people.

The *Sea-Ports* and coasts employ about another million.

The learned professions consist, in Great Britain, of about 36,000 ministers of religion of all denominations, about 24,000 lawyers and law employments, and 50,000 physicians, surgeons, apothecaries, and druggists, making 110,000 families of the 3 millions; or 1 to every 55 families for divinity, 1 to every 66 for law, and 1 to every 40 for physic: or, of the three, 1 to every 17.

By Marshall's Return, in 1821 and 1831, in the mining and hard-ware districts, the population had increased *one-third;* in the cotton, wool, &c. districts, *one-fourth;* in the metropolis, and sea-port towns, *one-sixth*.

and, in the inland towns and agricultural districts, only *one-eleventh*.

In regard to kinds of employments, the *agricultural* are about a third, the *trading* and *mining* nearly half, and the *unproductive* nearly a fifth. And, since the traders in the agricultural parishes are as about 1 to 5, and the population of the mining and manufacturing districts is about 5 millions, it follows that 4½ millions of the population of the mining and manufacturing districts are dependant on manufactures.

The other inhabitants of the United Kingdom consist of the Hereditary aristocracy, who are land-proprietors, constituting about 3 or 4000 families.

Of squires and gentlemen, who are land-proprietors, stock-holders, money-lenders, &c., there are 50 or 60,000 families.

Of destitute paupers, soldiers, &c. about 800,000 families.

In England, in 1811, 34·7 per cent. of the population were returned in agriculture; in 1821, only 33 per cent.; and, in 1831, but 27·7. The manufacturing were 45·9, 47·6, and 43·1; while the non-productive were 19·4, 19·4, and 29·2.

In Wales, the agricultural fell as in England, from 56·2 to 43·9. Trade from 27·7 to 26·9; while the non-productive increased from 16·1 to 29·2.

So in Scotland, agriculture fell, in the 20 years, from 31·3 to 25·2. Trade from 42·1 to 41·3; while the do-nothing classes rose from 26·6 to 33·5, or one-third.

In Ireland, but one return gave no comparison; but, in 1831, what are called agricultural were 63·8 per cent., trade 18, and the non-productive 18·2.

There are 608,712 male labourers, variously employed by retailers, shipping, &c.

And there are various traders and handicraftsmen, not in the other classes, amounting to 235,499.

And there are 113,224 male servants, and 671,491 female servants.

The line of Coal and Iron from Charnwood, in Leicestershire, to Scotland, north, and Wales and Whitehaven, west, is the demarcation of agricultural employments, and of manufacturing and agricultural. As Coals are used in the manipulations, they are the bases of the manufacturing system, and its site is the site of production. Coals render Leicestershire, Nottingham, Derbyshire, Warwickshire, Staffordshire, Cheshire, Lancashire, and Yorkshire, compact seats of manufactures, where iron is wrought in all forms, clay, and all fibrous materials, as wool, cotton, flax, silk, &c. With slight exceptions of particular fabrics, often older than the steam-engine, there are manufactories at Norwich, in Bedfordshire, in Wiltshire, and in Gloucestershire, with mining in South Wales, and in Cornwall. These branches of industry, according to Marshall, have subsisted about 350,000 families, or 2 millions men, women, and children.

The farmers who employ labourers in the United Kingdom, are 187,075. Those small occupiers who employ no labourers are 168,815. Then, taking the latter at 6 acres each, we have 33 millions of cultivated acres for the former, or an average for each of 176 acres. These employ 887,167 male labourers, or nearly 4⅔ to each farm, or 1 to every 40 acres, instead of the supposed average of 1 to every 25 acres.

The parliamentary returns give exactly 36,995,200 acres in England and Wales. The number of persons, in 1831, were 13,897,187; of families at 2,911,871, and inhabited houses at 2,482,444. It hence appears, that the number to each family is 4·773, and to each house 5·6, *i. e.* every 4 families consist of 19 persons, and every 5 houses contain 28 persons; and further, in the United Kingdom, to every man, woman, and every child, there are 2¾ acres of land, and to every family 12¾ acres for food and labour.

The Hardware trades in its 2 chief depôts, and other places, were believed, in 1835, to give direct employment to above 100,000 hands, and the goods they produced were estimated at above 16 millions, *i. e.* labour, 5 millions; materials, 3 millions; wear and tear, 3 millions; and profits, 5. Peace, however, has compelled Foreign Governments to employ their people; and, since 1836, our pig-iron is preferred to wrought, or cast, and other rough forms to finished, in fearful reduction of labour.

Above 5000 persons were engaged, till Railways, in Coach-making, in England and Wales. The number of stage-coach owners, drivers, &c. were about 12,000.

23,500 are employed as Cabinet-makers in Great Britain.

From 16 to 18,000 hands are employed in Hat-making, silk and beaver; and straw-hats employ full 20,0000 females between London, Dunstable, and Luton.

In Middlesex the idle to the industrious are 130,335 families to 183,704; but, in Bedfordshire, the numbers are 3,515 to 16,501.

In all England, every 100 families average 477 persons;—in London 432, in Lancashire and Cheshire 514, and in Sussex 516.

In 87,856 in Lambeth Parish, 2033 lived by prostitution; and 1 in 6 of all females between 16 and 40.

In 1835, the number of persons employed in the Government Offices were 23,578, with salaries amounting to 2,786,278*l.*, 4000 less than in 1815.

Nottingham, Derby, Loughborough, &c. employ 150,000 hands in the Bobbin-net manufactory, which returns above 1⅘ millions. Also, 16,000 in Cotton-stocking frames, which produce 2¾ millions dozens of stockings, at 8*s.* per dozen.

Between 400,000 and 500,000 persons are immured in factories from half-past 5 or 6 o'clock in the morning, till 8 or 9 at night, and this not on particular occasions, but during their whole lives, or as long as they are capable of employment.—*Brotherton.*

The highest wages of males in the Woollen trade, in Yorkshire, are 1*l* 2*s.* 6*d.*, in Gloucestershire 15*s.*, in Somerset 20*s.*, in Wiltshire 15*s.* 6*d.*, and at Aberdeen 15*s.*,—females but one-third.

Manufacturers, farmers, and traders in the several counties of Great Britain :—

Counties.	Manufacturers.	Farms.	Trade & Handicrafts.
Bedford	38	1330	5,502
Berks	521	1711	10 528
Bucks	369	2152	8,604
Cambridge	39	2421	8,792
Chester	13,305	4371	22,134
Cornwall	107	4608	15,254
Cumberland	3 214	3617	11,186
Derby	8,863	3320	14,787
Devon	1,221	9328	35,794
Dorset	722	2213	10,568
Durham	2,547	2229	19,035
Essex	871	4561	18,953
Gloucester	5,992	3675	29,716
Hereford	63	2505	7,576
Hertford	290	1518	9,426
Huntingdon		857	3,443
Kent	476	4361	34,251
Lancaster	97,517	6658	86,076
Leicester	12,240	2656	13 772
Lincoln	167	6901	20,490
Middlesex	11,064	1050	163,220
Monmouth	3,293	1648	6,649
Norfolk	4,740	5229	26,543
Northampton	582	3015	13,841
Northumberland	1,252	2376	17,149
Notts	14,260	2643	14,683
Oxon	711	2051	11,110
Rutland	12	429	1,373
Salop	1,353	3832	14,461
Somerset	4,350	6032	26 762
Southampton	292	2774	23,164
Stafford	26,755	3781	24,766
Suffolk	676	4526	18,167
Surrey	2,0 5	1873	44,139
Sussex	109	3160	19,208
Warwick	11,375	2838	32 579
Westmoreland	1,074	1435	3,621
Wilts	3,497	3587	13,089
Worcester	8,024	2636	13,693
York, E. R.	175	3331	12,917
——, City district	211	340	4,069
——, N. R.	1,005	49 0	12,749
——, W. R.	74,662	7096	60,109

In Wales, *Anglesey* contains 120, 1215, and 2190.—*Brecon*, 551, 1249, and 2818.—*Cardigan*, 218, 2002, and 2353.—*Carmarthen*, 292, 2735, and 5586.—*Carnarvon*, 143, 1506, and 3235.—*Denbigh*, 235, 2264, and 4604.—*Flint*, 630, 1010, and 2774.—*Glamorgan*, 1993, 1823, and 7571.—*Merioneth*, 194, 1112, and 1761.—*Montgomery*, 1639, 1938, and 3370. *Pembroke*, 131, 1842, 4785.—*Radnor*, 42, 1032, and 1179.

The greatest number of Manufacturers employed in counties in Scotland are—in Aberdeen, 2294; Ayr, 8311; Dumbarton, 1998; Dumfries, 1602; Fife, 7729; Forfar, 8574; Lanark, 26,677; Linlithgo, 4942; Renfrew, 9617; Stirling, 3776.

426 sub-divisions of trades exist in London. In rural towns and districts there are not 50, and often not 20.

Numbers in the Principal Occupations exercised in Great Britain, 1831.

	England.	Wales.	Scotland.
Auctioneers	2,365	98	360
Bakers	23 730	371	3,841
Barbers	7,580	133	736
Basket-makers	4,381	144	268
Blacksmiths	45,405	3,557	9,202
Bookbinders	3,023	88	488
Booksellers	2,732	55	549
Bricklayers	28,939	212	442
Brokers	2,431	7	203
Butchers	31,026	1,177	3,015
Cabinet-makers	17,646	465	3,663
Carpenters	83,810	4,601	14,838
Carriers	12 324	511	6,024
Cheese-mongers	2 424	24	93
Chemists	4,753	175	495
Clock-makers	7,720	228	944
Clothiers	1,870	155	760
Coach-makers	5,030	44	323
Coach-owners	8 557	266	1,691
Coopers	9,530	702	3,014
Copper-pl. Printers	2 302	8	353
Curriers	5,086	291	635
Cutlers	1 522	5	157
Dyers	6,517	127	1,223
Gilders	2,575	14	265
Glaziers	11,084	243	672
Grocers	18 217	415	3,515
Gun-makers	2,700	18	168
Harness-makers	3,984	67	265
Hatters	9,095	452	1,311
House Painters	13,839	235	1,579
Hucksters	9,257	200	1,424
Ironfounders	4,940	258	684
Ironmongers	3 862	100	567
Jewellers	4,779	31	421
Linen-drapers	11,809	412	1,380
Maltsters	6,124	424	431
Masons	31,631	3,577	13,947
Milkmen	5,216	63	516
Millers	15,921	1,212	2,663
Millwrights	1 489	35	337
Nailors	1,674	142	66
Opticians	798	1	59
Paper-makers	3,644	63	457
Pastry-cooks	2,703	52	346
Pawnbrokers	1,463	5	76
Plasterers	8,130	298	1,255
Printers	7 090	114	1 138
Publicans	52,621	3,070	5,540
Rope-makers	5,664	116	81
Sadlers	5,439	391	1,134
Sail-makers	1,114	24	98
Sawyers	15,178	858	3,145
Shipwrights	11,272	577	2,035
Shoemakers	110,122	5,819	17,307
Shopkeepers	31,312	1,724	5,214
Silversmiths	609	——	101
Slaters	2,496	504	1,539
Spirit Dealers	1 687	86	2,058
Stationers	2,378	26	393
Straw-bonnet-makrs.	1,876	67	100
Tailors	60,166	3,320	10,568
Tallow-chandlers	3,199	122	271

Tanners	4,521	311	717
Tea-dealers........	3,159	130	167
Tinmen	4,471	166	574
Tobacconists	1,718	11	495
Turners	5,160	112	630
Upholsterers	2,421	11	500
Wheelwrights......	17,444	818	1,288
Whitesmiths	9,007	105	431
Wool-combers	2,862	4	1

This enumeration is more curious than correct. Thus, the Excise licenses in Great Britain to malsters are 12,716; to soap-boilers, 276; to spirit-dealers, 67,500; to tea-dealers, 89,202; tobacco-dealers, 150,843; wine-dealers, 22,553; and publicans who deal in wine, spirits, and beer, 20,638.

The licenses in 1833, to auctioneers in the United Kingdom, were 3686; to retailers of beer, 90,833 and 35,609; to malsters, 13,243; to tobacco and snuff dealers, 167,785; to brewers only, 2364; to victuallers 70,446; to beer-retailers, 35,354.

There were, in 1835, in the United Kingdom, 3160 factories worked by steam, which employed 355,373 hands; of whom, 20,588 were under 12, and 144,000 from 12 to 18. The males, 190,710, and females, 196,918. The average in cotton was 174, wool 54, flax 96, and silk 129 per factory.

Irish labourers and operatives immigrate to our manufacturing towns, so that there are above 30,000 Irish in Leeds, 50,000 in Manchester 40,000 in Liverpool, and 36,000 in Glasgow.

Machinery, in reducing manual labour, affords an argument for the novel principle of encouraging the emigration of the industrious classes, and reducing a country to a skeleton of idlers and machines.

Upwards of 360,000 persons are actually employed in the cotton, woollen, and silk mills of this country, and a far greater number dependant upon them.—*Brotherton.*

No child under 13 can, by law, be employed more than 8 hours a day, or 48 hours per week; above 13 and under 18 years, can be employed more than 12 hours a day, or 69 hours per week.

Every factory, with its showy ranges of windows, and its busy hum of industry, is, nevertheless, a scene of suffering not to be looked at, or contemplated without horror. It has no modification but the consideration, that the beings thus immured have, like birds in cages, been long used to it, and know of no better state of existence!

Mr. Ashworth estimates the loss, caused by the Preston strike of the cotton-spinners, at 107,196*l.*, viz.:—57,210*l.* in wages of 8500 hands; 45,000*l.* loss to the masters on their capital; and 4986*l.* to the shopkeepers. A 23 weeks' strike at Derby, in 1833, occasioned a loss of above 60,000*l.* Such losses would be prevented by reference to masters to be named by the hands; for strikes are always caused by grinders, under-sellers, and makers of slights.

Sixty years may be considered as the limit of such a system of monopoly as enabled Britain, by her machine-products, to absorb wealth from other nations. From 1785 to 1792, the system began to take root, creating splendid private fortunes;—from 1792 to 1825, the system produced immense public balances of trade, which made the Treasury rich; but, from 1825 to 1838, hope was the support, and profits became doubtful. Nor should it be lost sight of, that our monopoly has depended on the raw materials of nations, now become competitors! Thus, we have manufactured *cotton* from the United States, *wool* from Saxony, &c., *flax* from the Netherlands and Hamburgh, and *silk* from Italy; our minerals alone being our own, yet not sufficiently exclusive to assure monopoly against cheaper manipulations. As it has been with other commercial nations, so therefore it must be with Britain. Our debt, and landed and monied monopolies, create however fearful peculiarities.

Inferences about increase of manufactures from increase of towns, are fallacious. One half the increase of towns has arisen from the consolidation of farms, and the destruction of farm-houses, by which rural population have been driven into towns.

By the police registers in France, it appeared that, in 1838, there were 46,000 Englishmen residing in France, which included 12,000 artizans and manufacturers.

The Hindoos, says Wight, have manufactured cotton for upwards of 3000 years; and, till within half a century, enjoyed a monopoly in muslins and fine calicoes. It is now exported in wool manufactured in Britain, and sold in India 20 or 30 per cent. below the native fabrics! The growth of Bourbon and American green-seed cottons is now adopted in place of the primitive wheel and loom of the ancient Hindoos, and India affords the best soil for the purpose.

In Bengal a beegah of land grows 320 cotton-plants, with which 108 yards of yard-wide cloth are made.

The Hindoos make extensive use of their toes for many purposes, to which Europeans only apply their fingers.

Every Russian, carrying on trade, must be a burgher, and a registered member of a guild or company; and of these there are three ranks, according to the capitals of the members:—10 to 50,000 roubles entitles to foreign commerce, exempts from corporal punishment, and qualifies a carriage and pair:—5 to 10,000 roubles are confined to inland trade:—1 to 5,000 roubles includes petty shopkeepers.

The best Turkey carpets are made by women, by rude means, at Ushak, 80 miles S. E. of Brusah —near the Marmora.

Women, all over Asia, and also in Africa, are degraded to the condition of slaves; and, yielding to their condition, are gross and lewd, indulging, without reserve, in personal indecencies, and in language which surprise and shock Europeans of both sexes. In Hindoostan, this degradation of the sex is not only a habit, but mingled with law and religion, and they fall into the scale assigned them.

In China, the first class are the literati: the second, the husbandmen; the third, the

artizans; and the fourth, the interchangers. The priests hold no office.

Poor and Poverty.

SOCIETY is the union of men for their common convenience. Live if ye can, is the Law of Nature; it is, therefore, the primary duty of all to be industrious, and, in some way, contribute to the common stock of provisions, necessaries, or enjoyments. Neither nature, nor the animal economy, nor the social relations, give countenance to idleness or inutility; and those are to be regarded as base and contemptible, who live only for the sake of living, or who, by some craft, or some abuse of institutions, seek to live by the industry of others. Those who produce nothing, and who contribute nothing either for their own support, or the support and enjoyment of others, are, in every community, a public nuisance.

It is still a blot in our criminal code, that transportations to the Antipodes are so unfeelingly numerous, and often for remainders of 7 years, return being impracticable; and, above all, that young females are sent, with such levity, for offences so trifling, as to disgrace even the mockery of law.

It was a standing joke of the noted Recorder Sylvester, and Alderman Curtis, that when Curtis was Sheriff, the numbers suspended after every Sessions fell together at the New Drop like pounds of candles!

When Mansfield was Lord Chief Justice, Thurlow Chancellor, and Rose Recorder, executions at Tyburn were so numerous, that the Editor, on one hanging *Holiday*, saw 19 on the gallows, the oldest of whom was not 22. For arresting these, and other legal enormities in 1807, he was speedily the victim of conspiracies, both in cast and fortune. Romilly, Eden, Bennet, Wilberforce, &c., however, adopted his views, and they are now Law.—*Letter to Livery of London.*

The prison for juvenile offenders is at Parkhurst, in the Isle of Wight.

In fact, CRIME IS *as* WANT and POVERTY, and CRIME and POVERTY are SIMULTANEOUS and *identical*. Passion may cause outrages, and covetousness may lead to thefts, but want and distress cause 49 crimes in 50.

That poverty is the chief cause of crime, is proved by the fact that, in 1803, the whole number of commitments were 3950; and, in 1819, 14 274; and in 1837, the prosecuted offenders were 23,612, or 1 in 588, of whom 17,090 were convicted, and 14,000 were petty larcenies. It was an increase of 10 and 12 per cent. on former years, and in that proportion a sign of distress occasioned by the wicked Poor Law. No less than 3000 were transported, while 8 only (for murder) were executed. 88 per cent. had little or no education!

The commitments in Ireland, in 1838, were 27,730, and the convictions 11,036. Tipperary and Dublin city stood the highest, or 3907 and 3299 committals.

Raumer says, that beggary in Ireland is more universal than in Switzerland, the Pope's dominions, or Naples, owing to absenteeism!

In 1822, while subscriptions were raising in England, to relieve a famine, by which thousands perished in Ireland, there were exported from Ireland 387,973 quarters of wheat, 565,612 quarters of oats, 343,719 cwts. of flour, 175,500 cwts. of pork, &c., 55,615 sheep, and 65,0?7 pigs, to meet the demands of absentee landlords!

In Massachusets, 1 in 68 is a pauper, supported by assessment; in New Hampshire, 1 in 100; in Connecticut, 1 in 150; in New York, 1 in 220; and in lower proportions in other states. This poverty is produced by ardent spirits.

One-twentieth of the population in France is considered as poor, and one-sixth in the United Kingdom.

The *Academie Française* gives prizes and medals for virtuous conduct and meritorious actions. In 1830, 6000 francs to an indefatigable Hospital nurse; 5000 to the humane wife of the keeper of a Prison; 3000 to an intrepid fireman; 1500 for faithful servitude, &c. To 7 others, medals worth 600 fr.

In the 25th chapter of Leviticus is to be found the *neglected* institution of the wise and benevolent year of Jubilee.

The poor, under the Mosaic law, were entitled to the tithe of every third year; to one-sixtieth of the crops every year; and to full half of every seventh year.

Gleaning also is the right of the poor, according to the law of God, as set forth by Moses. By that law, no man can rake his field, but all that is left belongs to the poor.

Every great branch of trade might be made to provide for its own sick, crippled, and aged members, by weekly contributions from wages and masters, in the way in which Greenwich Hospital is maintained; and deficiencies, when they arise, be made up from assessments. An industrious operative, or ingenious mechanic, is entitled, in old age, to at least as much public gratitude as a soldier or sailor.

1000 pauper children are born in London, in workhouses, per annum; and from 13 to 18,000 are in all the workhouses.

It was estimated, in 1810, that there are, on an average, 15,000 beggars in and round London, who obtain from 1*s.* 6*d.* to 5*s.* daily.

Contrary to the policy of all ages and nations, a system of emigration has not only been encouraged of late years, but even enforced by authority! In consequence, full 100,000 per annum have, for some years past, been *driven* from the country. The Custom-House returns make it 103,313 in 1832, and this would be only a portion. There are even Public Agents with public money, for the purpose, and Parish Funds are thus applied. An alarm is excited that there are too many people for the land, or *rather for the property!* The non-producing classes are active in thus removing the producers.

It appears, by very accurate calculation, that with the severest economy, a labourer in the Northern Counties, his wife, and six children, cannot live on less than 86*l.* per an-

man, while the current wages of man, wife, and three children, do not exceed 6s., which a cow, pigs, and a garden, may raise to about 7s.—*Huddersfield*.

In the autumnal months of 1829, it appeared that 13,226 individuals, connected with the manufactures of Huddersfield, were reduced to live on 2½d. per day; and that 5½d. per day was the pay for a day's labour.

In the 13th and 14th centuries, the wages of labour were equal to the price of a quarter of wheat in 21 days. This, at 63s. per quarter, would be 3s. per day, the least sum that could keep a healthful labourer and family from destitution. At the Revolution, the pay was 7s. per week, and since then money has fallen in value five-fold, and on land, &c. full eight or ten-fold.

Pawnbroking, in all its shades, operates as a cruel robbery on poverty. There are 380 in London, 1096 in the counties, and 61 in Scotland. It is a safe means of making 15 or 20 per cent. by money, when those who pay such interest cannot afford even to pay 5 per cent. In Paris, 12 per cent. is taken, and there are usually in pledge 6 or 700,000 articles, at an average of 18 francs. Foreign Monts-de-Pieté take no interest, or very trifling. Interest prevents redemption, in 19 cases out of 20. A pawnbroker, in Glasgow, lately had in pawn 539 coats, 355 waistcoats, 1980 gowns, 540 petticoats, 90 pelisses, 240 silk-handkerchiefs, 294 shirts and shifts, 60 hats, 262 pair blankets, 300 pair sheets, &c. 48 umbrellas, 102 Bibles, 204 watches, 216 rings, and 48 soldiers' medals.

In Chelsea parish, of about 40,000 inhabitants, 12,000*l.* per annum is falsely collected as *Poor* Rates, whereas 3217*l.* of it is applied to the Police, and 1442*l.* to the County Rate, sums which are artfully excluded when Unions are formed under the late law, and the exclusion then treated as a saving! The whole that reaches the poor is 2042*l.* for provisions in the workhouse, 1310*l.* for miscellanies, 2390*l.* for out-door relief, and 619*l.* for medical relief, about 6300*l.* The gross rate is 1*s.* 11*d.* per pound, of which about 1*s.* 1*d.* reaches the poor.

The poor's rates, in 1826, were 7 millions, of which 4¾ were drawn from land, nearly 2 from dwelling-houses, and the rest from manufactories. Usurers, mortgagees, and fundholders, are not assessed.

Paupers in Lambeth workhouse cost 4*s.* 10½*d.* each per week; in Whitechapel, 2*s.* 9½*d.*; Shoreditch, by contract, 3*s.* 7*d.*

Immense benefits are imparted to poverty by allotments of land at fair rents. It gives the poor a stake in the country, promotes sobriety, and increases subsistence.

The poor, in general, consider a workhouse and a prison as synonymous. Poverty, therefore, begets desperation; and desperation crime.

That kind of fund by which every trade might support its own indigent and aged members, has lately been established among the London booksellers. The arrangements have been carefully made, and, in working, we trust it will meet, in a fraternal spirit, the necessities of men who have devoted their lives to the history of books, and their eyes as honest assistants, so that the trade may rise in the moral estimate of society.

Average Parochial Assessments for Poor, and various other local purposes:—

1812 to 1818	£8,146,629
1819 — 1825	7,789,897
1826 — 1832	7,881,435
1834 — 1836	6,317,254
1836 (Poor only) ..	4,717,629
1837 (Poor only) ..	4,044,741

Besides the heavy expences of new workhouses, lunatic asylums, &c., and the salaries of commissioners, subs, &c. equal to 54,252*l.*

Taking the annual profits of the United Kingdom at 200 millions, the poor-rates, at 6 millions, are only 3 per cent.; at 8 millions 4, and even at 10 they would be but 5 per cent.; a small return to age, disease, and misfortune.

The poor-rates are so unequal, that 4 million acres, with a rental of 10 millions, pay but 750,000*l.*; and another 4 millions, with a rental of only 3 millions, pay 1½ million.

Poverty, says the Diffusion Society and its disciples, quickens men's industry; therefore, say they, let us increase it by the new Poor Law.

The assessments for indemnifying the poor have risen, since 1748, from 600,000 to 7 or 8 millions; but, it is computed that the profits, from the use of machinery, and the rise in rents, amount to 50 or 60 millions, or 8 times more than is assessed to reimburse those who formerly performed the labour of machinery, or lived on the land.

The assessments for the poor in England and Wales, according to Marshall's Tables, have been as under:—

	Assessed.	Expended.	Wheat.	
1750	730,125	689,971	27	11
1776	1,721,316	1,521,732	48	4
1785	2,167,748	1,912,241	49	9
1803	5,318,204	4,077,891	63	2
1813	8,646,841	6,676,105	128	8
1819	9,320,440	7,890,148	90	7
1826	6,965,051	5,928,504	64	4
1827	6,966,157	6,766,829		
1830	8,161,281	6,829,052	65	6
1832	8,622,920	9,683,420		

The charitable bequests, held by parishes, for the use of the poor, amount to nearly 250,000*l.* per annum. Those seized by Henry the VIIIth, and given to flatterers, are now worth 10 millions.

The annual rentals and dividends of endowed charities were, in 1829, 5,506,263*l.*

The unprincipled Poor Law has been forced by the Whig administration into no less than 662 Unions, to the utter ruin of the poor. 375 parishes have been protected by local acts, and 283 under Gilbert's act. No less than 328 of the loathsome buildings, commonly called Bastiles, have been raised into operation, and 141 are building, in spite of the loud reprobation which in a short time must reduce the whole to memorable follies. The reports of the parties are to be

regarded only as pleadings for the continuance of salaries.

Returns have been made to Parliament of 543 of these Unions in England and Wales. Their impracticable absurdity is proved by their size. Bedford is 152 square miles. Hungerford 150. Wycombe 147. Wisbeach 184. Nantwich 177. Newmarket 150. Penrith 269. Wigton 214. Tavistock 242, &c. an insult on guardianship and controul.

The sums advanced in Exchequer bills, in 1836, to build obnoxious prisons for the poor, were 40,254*l.*, 55,087*l.*, 530,150*l.*, 86*l.* and 16,205*l.*, in all 641,000*l.*, and 633,241*l.* had been granted before 1836.

As there are 46 millions of cultivated acres in the United Kingdom, and not quite 5 millions of families, there are 9 acres to a family; therefore, a wise paternal distribution might secure abundance to all who contribute their due proportion of labour.

The scheme of Savings' Banks, in November, 1837, included in the United Kingdom 636,066 accounts, and a gross capital of nearly 20 millions.

In all questions about the poor, it should be considered that law-makers and governors are of the class of the rich; and that, to improve the condition of poverty, concessions and sacrifices are demanded of the rich. The most that the laws of wealthy legislators attempt, is to vary the relations of poverty and industry; and, it is forgotten, that of nothing, nothing can come. In British society, 9-10ths of the property is divided among 1-10th of the people, or, in other words, only 1-10th of the property is divided among 9-10ths; and, it is the unwearied study of the rich law-makers and the 10th to protect their own rights, whatever may be the consequence to the 9-10ths.

Wealth and poverty, in a community, are mere relations of the *common stock* of property. When a man gets rich, he abstracts from his neighbours; and, when others become poor, their property has, by some means, passed to others. If a merchant imports, he uses his trade only as a means of personal accumulation. If he increase the public stock of 1000 to 1001, he merely reduces the relative value of every portion.

Every wise and just king should, as his primary duty, be the king and protector of the poor, and leave the nobility and wealthy to their own power to protect themselves. Kings ought to know that they are *the balance-wheel* between wealth and poverty; and no king, worthy of his office, ought ever to sanction laws made by aristocratic legislators to rob and oppress the poor.

It is with the poor-laws as with other laws, they must be just and liberal to be respected and become operative. Harsh and cruel laws are always defeated by the moral sense and christian charity of the community. A reckless and insulted poor will not be managed with less expence than a grateful poor.

It might have been hoped by philanthropy, that, when machinery was made to perform the labours of the people, there would be more general enjoyment with less labour; but, as the proprietors either got the difference, or it is given to foreigners in reduced prices, philanthropy is disappointed.

This rule does not, however, demand that all should dig and delve, since the general good requires various employments; and the merchant, interchanger, scholar, artist, physician, player, or buffoon, are severally useful in their way, provided such employments are not made a cover for idleness, or are not unduly multiplied.

Virtue and industry ought to be singled out, promoted, and specially honoured by formal institutions; while vice and incorrigible crime should be subject to ignominious punishments. Youth should be usefully educated and trained to some employment, and virtuous old age be honourably provided for.

The Greeks and Romans duly provided for the poor. Austria, France, Prussia, and Russia do the same.

The Brahmins take a tenth for the poor; and the Mahometans are enjoined by the Koran to provide for them.

Pauper colonies have been established in Holland for the relief of poverty, by General Van den Bosch. With funds of 5380*l.* the society purchased an estate on the east side of the Zuyder Zee, and not far from the town of Steenwyk.

NAVIGATION AND INTERCOURSE.

The Phœnicians were the first navigators, and sailed in all seas. The Romans and Chinese were early and able road-makers; but, in Europe, generally, down even within two centuries, the roads had dwindled into mere horse-paths, just wide enough to permit 2 loaded horses to pass, aided by bells for narrower ways. Within 100 years, some roads began to assume capability for wheel-carriages in the United Kingdom; and, since then, roads have been converted into canals, and now canals into railways, with locomotive carriages in vast trains, and a regular speed of from 20 to 35 miles an hour. The face of society and industry will thus be changed, and the United Kingdom rendered one vast and combined metropolis! Nor are these changes limited to land,—for the ocean is covered with steam-vessels, which, in despite of winds and tides, connect all ports with a celerity which renders winds and sails both useless and ruinous. The entire economy of roads and canals, and of sailing vessels, is therefore, in rapid course of change, and our facts must refer not to what is passing away, but to what will be in another 20 years.

The earliest recorded traders were the Phœnicians, who were succeeded by Carthage, Egypt, Venice, Genoa, and the Hanse Towns; Holland and Portugal followed: but, for above 100 years, Britain has obtained the ascendancy, and the United States are now rapidly advancing. Commerce and feudality seem to be incompatible with each

other, and trade never flourishes but in free and citizen states.

Navigation was natural to the Venetians, and they absorbed all commerce from the year 1000 to 16 or 1700, having for rivals the Genoese and the Hanseatic league, in which Lubeck, Bremen, and Amsterdam, took the lead; and Bruges, Antwerp, Dantzic, and Hamburgh concurred. The Dutch republic and civil liberty, for 2 centuries, tranferred the trade of the world to Holland; but, in the middle of the 18th century, the tonnage of England increased to half a million.

In the 15th century, the Argosese and Galeasses of Venice, from 100 to 300 tons, to the number of 3000, connected the commerce of Asia and all Europe. Her exports were 10 millions of ducats, at 9*s*. 3*d*., and her profits four millions.

The Hanseatic League began about 1200, between Hamburgh and Lubeck. It then extended to Cologne and Dantzic, and finally included eighty commercial cities, for the protection of the sea against pirates, &c. Every three years they held a congress, and, becoming very rich, they aimed at political influence, and hence the ruin of the League.

Whenever marine engines are generally substituted for masts, sails, and rigging, we may suppose, that, on the average, every vessel will quadruple the number of voyages per annum, and will double the present mean tonnage; so that, instead of 24,000 vessels, the same business will be done with 3000. The cost of coals bears no comparison to the cost and ruin of contrary winds. Packets have been a week on a voyage to Margate, 2 or 3 days to Gravesend, 4 or 5 days between Dover and Calais, and a month on way from Bristol to Tenby. Colliers have been wind-bound for a month at Newcastle,—ships from the Atlantic are often detained even to the famine-point in the chops of the Channel, while freights are perishing, and markets lost. In fact, in 1940, no one will give credit to the miseries created by the uncertainty of sails and winds.

It is the same in regard to railways. The time wasted—the severe labour of a long journey—the dependance on horses, coachmen, axle-trees, dark roads, &c,—the 3 hours for 12, and the 10 for 40, with perfect ease and elbow-room, will place horses and coaches at an immeasurable distance from railways; so that, sooner or later, all travelling in civilized countries must be performed in steam-carriages, and horse carriages reserved only for short distances.

It seems therefore proper, in the present article, to treat of public travelling by coaches, and of navigation by sailing-vessels as in transitu. There will be horse-carriages for private and local uses, but, as great machinery governed by science, they must be secondary. Within a few years, the great lines of road will be entirely traversed by railways, as well as by lines joining great towns. Already, where railways are established, coaches are reduced as 5 to 1, and the experienced convenience of railways will soon reduce them as 30 or 40 to 1.

As to marine intercourse, there can, also, be no doubt that sailing must soon yield to the steam-engine. Capital in ordinary shipping may resist for a time, but the certainty and celerity of steam-ships will, ultimately, command general use, both for passengers and the transport of merchandize, which, in all cases, seeks the earliest market. Every time we hear of a new steam-ship being placed in a line of trade, we may be sure that she supercedes eight sailing-vessels.

At the same time, while these changes for presumed public benefit are in operation, onerous duties devolve on the justice of governments. If the owners of the negroes had their 20 millions of indemnity, the 40,000 families put in danger of the Poor-house bastiles, merit the most liberal compensation; and re-payment should be cheerfully made by assessments on the produce and profits of the new concerns.

While Fulton was in England, converting a speculation into a reality, he was on friendly intercourse with Sir R. Phillips; to whom he dispatched a triumphant letter on the evening of his first voyage on the Hudson. This letter was shewn to Earl Stanhope, and 4 or 5 eminent engineers, but treated with scorn, as descriptive of an impossibility! Sir R. Phillips then advertized for a company, to repeat on the Thames what had been done on the Hudson; but, he obtained only 2 ten-pound conditional subscribers, after expending some pounds in advertizing! He then printed, with commendation, FULTON's letter in the Monthly Magazine, and his credulity was generally reprobated! Then, for several years, the American accounts were treated as falsehoods, till a man ruined himself by launching a steam-vessel on the Clyde; though, afterwards, a Clyde vessel was brought round to the Thames. In her first voyage to Margate none would trust themselves, and the Editor and 3 of his family, with 5 or 6 more, were the first hardy adventurers! To allay alarms, he published a letter in the newspapers, and, ere the end of that summer, he saw the same packet depart with 350 passengers!

The art of working oars or paddles, by oxen in a circular wheel, was known to the ancients, and used in the middle ages; and even on the Thames and Medway after the Restoration. The invention of steam-vessels consists, therefore, in exchanging the working power from animals to the steam-engine. This last application was made by Garay at Barcelona, in 1543, and perhaps, by the Marquis of Worcester, at London, in 1663. Hulls improved on this, in 1737, and published a description, with a drawing. Three Scotchmen afterwards made experiments. It was, however, a mere speculation till taken up by FULTON, in 1806-7, and introduced on the American rivers. Thence, Bell introduced it on the Clyde.

The first idea of steam-navigation was set forth in a patent, obtained in 1736, by Jonathan Hulls, for a machine for carrying vessels against wind and tide, or in a calm. In 1778, Thomas Paine proposed, in America,

this application of steam. In 1781, the Marquis de Jouffroy constructed one on the Soane; and, in 1785. two Americans published on it. In 1789, Symington made a voyage in one on the Forth and Clyde canal; and, in 1802, the experiment was repeated with success. Soon after, Fulton went to America; and. in 1809, started a steamboat on the Hudson's River, which succeeding, was imitated by hundreds.

We have, within a century, performed three grand experiments for internal intercourse. 1. 25,000 miles of turnpike-roads. 2. Canals and improved rivers, at a vast cost; and 3. Railways for directive locomotive engines, the last superceding the two others; but whether *the last*, however plausible, is uncertain. It is a preparative for a long career of prosperity, and part of the public capital spent to assure it. The completion will cost at least 100 millions, entailing a further annual charge on the public industry of 8 or 10 millions; for, in this and all cases, we do not improve by *capital*, but by the increase of *debts*.

Turnpike-roads were first established in the reign of Queen Anne: till then all roads were repaired by the parishes. One R. Phillips, in 1736, published the first tract on road-making.

Turnpikes were so called from poles or bars, swung on a staple, and turned either way when dues were paid.

In 1829, the Turnpike Roads of England were 18,244 miles; in Wales, 2631; and in Scotland, 3666. Total 24,541 miles, probably now 25,000. The miles in Yorkshire, 448; in Lancashire, 631; in Middlesex, 158; in Devon, 782: in Salop, 988. In Scotland, Ayrshire had 486; and, in Wales, Montgomery 450. In Middlesex, the annual cost was 550*l*. per mile, and in Yorkshire but 60*l*. and in Salop but 20*l*. The average of Great Britain was 49*l*.

A turnpike-road, by law, is 60 feet; and parish-roads about 30 feet.

Stones for roads are broken to six ounces, but rounded pebbles do not imbed. Ten inches depth of well-consolidated materials are sufficient, whatever the substratum, and better soft than hard or rocky. Five tons of sized stones over a morass last as long as 7 on a hard bottom.—*M'Adam.*

A fall of three inches from the centre to the sides, is sufficient in a road of 30 feet.

7° or 8° is the greatest angle for carriages, 15° for beasts of burden; and 35° cannot be ascended by a man without steps, and even with steps 44° is very difficult.—*Saussure.*

In roads, the draught in a rise or fall is 262·2, more or less, at 1 foot in 9. 236, at 1 in 10; 118, at 1 in 20; 78·7, at 1 in 30; 47·2, at 1 in 50; 1 in 100 23·6; 1 in 150, 15·7; 1 in 200, 11·8; 1 in 400, 5·9; 1 in 600, 3·94; 1 in 1000, 2·36; 1 in 2000, 1·18; and 1 in 4000, 0·59. The difference between a rise and fall, of 1 in 156 feet, in pounds, in the draught of a stage-coach, is 128 and 82; of 1 in 245 feet, is 125 and 96; and 1 in 600, is 112 and 100.

The average resistance of a waggon on a level road is 73 lbs. per ton. The force of traction, on a well-made pavement, is 33 lbs. per ton. On a macadamized road, 65 lbs. On a gravel road, 147 lbs. On a broken stone-road, with a hard foundation, 46 lbs.

By heavy waggons, at 2½ miles per hour, the cost is 8*d*. per ton per mile. Light vans, at 4 miles, 1*s*. A 4-horse stage varies from 16 to 18 cwt., and carries 2 tons of passengers and luggage, at 9 miles per hour, at 3*d*. per passenger per mile, or 3*s*. per ton per mile.

Holborn-hill has a rise of 1 in 18, Ludgate but 1 in 36; less than 1 in 12 requires the wheels of carriages to be locked.

In the evidence about M'Adam's roads, it appeared that stage-coach horses lasted from 3 to 6 years; and that light-coaches generally weighed 2½ tons; the coach 1, the passengers 1, and the luggage ½.

It appears, by the evidence of the chairman of the commissioners of the metropolis roads, that the debts for money borrowed upon the trusts throughout England, Wales, and Scotland, which amounted, in 1821, to 6,000,000*l*., amounted, in 1833, to 8,000,000*l*.; or 320*l*. per mile, for money *borrowed*.

The first coach in England was built in 1565, for the Earl of Rutland. In 1661, a stage-coach was two days going from London to Oxford, and the flying-coach in summer was thirteen hours.

The chariots of the ancients were like our one-horse chaises, or phætons. Close-carriages began to be used by persons of the highest quality in the 14th and 15th century. Paris had three in 550, and Henry IV. one, but without straps or springs; and, in the same age, there were thirty-six at Warsaw, drawn by six horses. In sundry places, men were forbidden to ride in them, as effeminate. They were first made in England in the reign of Elizabeth, and were then called whirlicotes. The duke of Buckingham, in 1619, drove six horses; and the duke of Northumberland, in rivalry, drove eight. They were first let for hire in Paris, in 1650, at the Hotel Fiacre; and, hence, their name. In London, they were first let for hire in 1625, and were 20 in number: in 1637, they were limited to 50; and, at the restoration, 400 were licensed.

In 1828, the four-wheel carriages in Great Britain were about 28,500; the post-chaises 6596; the stage-coaches 2996; the gigs, &c. 48,800; and tax-carts 19,500.

Mail-coaches pass from London to Caermarthen, 204 miles, in 27 hrs., 31 min.; to Devonport, 219 miles, in 23 hrs., 48 min.; to Thurso, 799 miles, in 105 hrs., 45 min.—which includes York, 196 miles, in 21 hrs., 31 min.; Edinburgh, 399 miles, in 43 hrs., 38 min. They keep time to a minute by regulation at every stage, the average pace being above 9 miles an hour in England.

Telegraphs in England used to transmit signals at 5 miles a minute; but, on being prepared, 100 miles per minute.

There are round London 850 stages and omnibuses, making 6800 journies per day.

The effect of railways on canal property

has not been stated; but, as celerity will compensate for extra expense, it may be expected that canal tonnage will decline.

The Caledonian Canal is 60¼ miles long, 15 feet deep, and 120 to 50 broad, with 28 locks; but, in 16 years, it has not paid the interest. Its expense was a million!

536 miles of canal in the United Kingdom, have been made since 1800.

The Regent's Canal, round the North of London, is 8 miles long. It passes from the Thames at Limehouse, is 45 feet wide, and rises in 13 locks, 84 feet, passing through a tunnel at Islington, of 896 yards, and another at Paddington, of 440 yards, to the basin of the Grand Junction, which joins it to the inland navigation of the kingdom. It is crossed by 37 bridges.

The Ellesmere Canal passes over the Dee at Chirk, in an aqueduct of 600 feet, in 10 arches; and again at Pontay-Sylte, in the Vale of Llangollen, 127 feet long, 65 feet high, in an iron aqueduct 1010 feet long.

There are 104 canals in the United Kingdom. The Leeds and Liverpool 130 miles, the Ellesmere 109, the Grand Trunk 93, with 37 of branches, the Grand Junction 93½, with 53 of branches, and the Oxford 91, are the longest. The oldest is the Bridgewater, in 1758, and the next in 1770. Whether they will maintain themselves against railways, can only be determined by experiment.

In 1838, there are 2200 miles of canal in England, and 1800 of improved river navigation. In Ireland, there are 300 miles of canals, and 200 of rivers.

France has about 2400 miles of canal navigation. The navigable rivers of France are between 4000 and 5000 miles, and of England about 1800.

The Grand Canal from Dublin to the Shannon is 80 miles, with 8 branches of 75 miles.

The Shannon has 10 steamers.

Besides the Grand Canal there is the Royal, 92 miles; the Henry, 21 miles; and the Ulster, besides 5 or 6 navigable rivers. The tonnage 600,000, at 1*d.* per ton per mile.

The Canadian Canal (Welland) joins Lakes Erie and Ontario, avoiding the Falls of Niagara. It commences at Grand River, and, in 1¾ of a mile, descends through 17 locks; and then, in 2¼ miles, 12 locks; descending 322 feet, to Port Dalhousie.

Three rapids obstruct the navigation of the St. Lawrence, 3000 miles to the extremity of Superior. St. Mary between it and Huron, Niagara, and Montreal. But the Welland Canal, of 42 miles, joins Erie with Ontario for vessels of 100 tons, with 37 ascending-locks of 9 feet each. The Lachline Canal of 9 miles, and another of 40, avoid the Montreal rapids; while the Rideau now joins Ontario to the Ottowa, and by it makes a perfect water communication of 259 miles from Kingston to Montreal.

The Rideau is one of the most stupendous undertakings of modern times. It extends a distance of 160 miles, between the Ottawa river and Lake Ontario. The canal has been estimated to cost £196,000, and when finished as far as the summit level, steamboats may go from Quebec to Lake Superior.

There is a canal of 60 miles across Nova Scotia, with 15 locks, from Halifax Harbour to the Bay of Fundy.

The canal for uniting the Atlantic and Pacific will, it is hoped, be completed in 1839. The line extends from St. Jean de Nicaragua, following its course to the great lake, a distance of 130 miles. It then proceeds across the lake to Nicaragua, 97 miles, and thence to Borette in the Gulf of Popaya, 16 miles, making the total 253 miles.

A canal of 40 miles has been cut from Foua, on the Nile, to Alexandria, by which the Delta and the Bar is avoided.

The Bute Docks and Canal, at Cardiff, to aid the export of iron and coal from Merthyr Tydvil, &c. &c., are among the great improvements of the country.

Sailing-Vessels.

In 1803, we had 20,893 ships, and 2,167,863 tons. In 1816, 25,801 ships, and 2,783,933 tons. In 1830, 23,721 ships, and 2,531,819 tons. And, in 1837, 24,343, and 2,651,655 tons, manned by 163,641 hands.

From 1000 to 1400 ships are built annually, shewing that the mean duration is about 20 years.

New Vessels built, with the Amount of their Tonnage, in the year ending Jan. 5, 1839.

	Vessels.	Tonnage.
United Kingdom	1,089	157,255
Isles of Guernsey, Jersey, and Man	58	4,204
British Plantations	343	45,811
Total	1,490	207,270

The proportion of steamers does not appear.

Number of Vessels, with the Amount of their Tonnage, and the Number of Men and Boys that belong to the British Empire on the 31st December, 1838.

	Vessels.	Tons.	Men.
United Kingdom	20,300	2,383,484	143,007
Isles of Guernsey, Jersey, and Man	612	37,275	4,350
British Plantations	5,697	469,842	31,226
Total	26,609	2,890,601	178,583

Shipping entered Inwards in the United Kingdom, from Foreign Parts, 1838.

	Vessels.	Tons.	Men.
British & Irish Vessels	16,119	2,785,387	154,499
Foreign Vessels	8,679	1,211,666	68,891

Shipping cleared Outwards from the United Kingdom, to Foreign Parts, 1838.

	Vessels.	Tons.	Men.
British & Irish Vessels	15,907	2,876,236	162,763
Foreign Vessels	8,520	1,224,803	68,386

A sailing-vessel of 400 tons, and 20 crew, costs 750*l.* to 800*l.* wages, per annum, besides provisions, 10*l.* per week.

The coasting-trade of the United Kingdom, including colliers, employs about 3000 vessels, of which 1200 are colliers.

There were 107 custom-houses in the United Kingdom, and the vessels registered at each, as belonging to the Port, were as follows, in 1835:—

	Vessels.	*Tonnage.*
London	2,663	572,835
Newcastle ..	987	202,379
Liverpool	805	161,780
Sunderland ..	624	107,628
Yarmouth....	585	44,134
Hull	579	72,248
Whitehaven ..	496	72,967
Beaumaris ..	389	22,076
Greenock	371	36,241
Aberdeen	350	46,201
Dartmouth ..	349	24,114
Bristol	316	49,535
Plymouth	302	24,838
Dundee	299	31,986
Dublin	289	23,904
Cardigan	281	14,643
Leith	263	26,362
Whitby	258	41,576
Cork	256	17,093
Rochester	255	10,816
Belfast	247	24,989
Gloucester ..	247	13,026
Glasgow	235	41,121
Colchester ..	235	6,745

The others making up 19,143 vessels with 2,225,980 tons, averaging 116 tons. Guernsey, &c. had 521 of 35,880 tons, and the Colonies 4771 of 356,208 tons.

The Newcastle coal-trade employs 950 ships of 212,703 tons, and 10,975 men and boys; 68 vessels, per annum, are wrecked, and 170 lives lost. Vessels are valued at 10*l*. per ton.

7400 ships bring about 2,100,000 tons of coals to the Port of London, of which half are from Newcastle, and a third from Sunderland and Stockton. The Scotch and Welsh send about 35,000 tons each. Yorkshire, with its vast coal-fields, but half this quantity.

There entered the Port of London, from foreign parts, in 1831, 5610 ships; in 1832, 4048; and, in 1833, 4396; average tonnage 190 tons.

The number of coasting-vessels which arrive in the Port of London annually is about 19,000, or three times the number at the beginning of last century.

The Colliers to London, in 1832, were 7437, in different voyages.

There are often nearly 1000 vessels, of all sizes, in the Port of London, and about 80 steam-vessels.

The British ports provided with docks are Liverpool, London, Bristol, Hull, Goole, Gloucester, and Leith.

The 22 docks of Liverpool cover 111 acres, and the quay spaces around them are 8 miles, and beside the river 2½ miles. The Prince's dock is 57,129 square yards; the Queen's, 51,502; the King's, 37,776; Brunswick, 60,824.

The cost of the 22 docks and dry basins has been above 2 millions. The first, erected in the reign of Anne, is now filled up. 12,000 vessels enter, inwards and outwards, per annum.

Salthouse Dock, at Liverpool, is 3½ acres, formed in 1760. George's Dock is 6 acres. King's Dock is 7½ acres. Queen's Dock is 11 acres. Their United Quays are 2 miles, and there are usually 400 vessels in them. The new Docks, and the enlargement of the others, cover 62 acres, including the Building, Repairing, or Graving Docks.

The following is the capital, in 100*l*. shares, engaged in the London Docks:—

St. Katherine's	2,527,732*l*.
London	3,114,000*l*.
West India	1,380,000*l*.
East India.............	483,750*l*.
Commercial...........	3665 shares
East Country	1038 shares

The several London Docks occupy, in water, wharfs, warehouses, &c. 295 acres.

The West India Docks, in the Isle of Dogs, formed in 1800 and 1802, cover 68 acres; and the buildings, &c. 72 more. They cost 1½ million, and hold 204 vessels. The shed, near the quays, is a quarter of a mile long; the frame-work and supports are wholly iron. Beneath are extensive vaults for rum and spirits, wholly lighted by day-light reflectors and reflections.

The St. Katherine's Docks cost 1,700,000*l*., and cover 24 acres, in clearing which, 1250 houses were pulled down. It will accommodate 150 ships, besides small craft.

The London Docks cover 25 acres, 29 feet deep; the entrance basin is 12½ feet; and these, with the quays, sheds, and warehouses, four stories high, with extensive vaults, cover 110 acres.

In 1831, the ships entered at the following ports were

Amsterdam, (1833)	2,374
Antwerp.......................	955
Barcelona	2,720
Batavia	960
Bourdeaux, about..............	400
Boston..........................	550
Bremen	881
Cadiz, (1834)..................	634
Calcutta	686
Canton, about	900
Cape of Good Hope, about	900
Charles Town, about	200
Dantzic	1,060
Hamburgh.....................	1,584
Havannah	1,058
Havre..........................	1,074
Leghorn, about................	450
Lisbon, about	300
London, about	22,000
Liverpool	10,703
Marseilles	2,048
Memel..........................	869
New York, about..............	6,000
Odessa.........................	700
Petersburgh (1833)	1,278
Quebec, (1836)	879
Riga............................	1,162
Sound, passed (1837) 3432 British	14,101
Swinemunde	809

Smyrna, about	600
Sydney	120
Trieste	280

In some of the above, the returns apply only to foreign trade. Others include vessels of all kinds.

There are 11,166 fishing-boats belonging to the ports of Great Britain, the highest 1224 to Tobermory, and 603 to Lerwick.

In the 3 years, 1816, 1817, and 1818, 1203 ships were lost; and, in 1833, 1834, and 1835, 1702,—the cargoes 6 and 8½ millions; and, in the 6 years, 5000 of the crews and passengers were drowned.

10,026 ships, averaging 110 tons, have been employed between Great Britain and Ireland.

The tonnage of Jamaica, in 1835, was 157,000; that to Guiana 47,000, to Trinidad 20,000, and to Barbadoes 21,000; the whole being 245,000 in 900 ships.

The trade with Germany is almost entirely with steamers.

The tonnage of France is 797,684; of which, 228,000 is colonial trade.

British and colonial-built vessels and prizes must be duly registered at the ports to which they belong. Copies of the registers are annually sent to the Custom-House, London. The master and three-fourths of the crew must be British subjects. The property in every ship is divided into 64 parts; but 32 persons only may at one time be owners. The majority of owners appoint the master or captain.

On the accession of George III., the British tonnage was 540,241.

In 1770	896,495
1780	731,286
1790	1,424,912
1800	1,445 271
1810	1,624,120
1820	2,508,190
1830	2,517,000

The foreign ships which cleared out were, in tons

1760	107,237
1780	154,111
1800	685,051
1830	710,300

To prevent confusion in sailing, vessels to starboard keep their course; and those to larboard are bound to tack.

There are 108 light-houses on the English coast, 51 of which are for ports or harbours. 53 in Scotland, 28 for harbours; and 37 for Ireland, 14 harbours. There are, also, 18 floating-lights in England and 3 in Ireland. In all 219, of which, 127 are public, 55 are under the Trinity-House, 23 under the Commissioners of Northern Lights, 85 under the Irish Ballast-Board, and 14 are leased to private persons. They collect 240,000*l.*, and cost 97,000*l.*

A new method of illumination, proposed by Gaudin, is stated to be an improvement of the Drummond Light. Drummond pours a stream of oxygen gas through spirit of wine, upon unslaked lime; but, Gaudin employs a more ethereal kind of oxygen, which he conducts through burning essence of turpentine. The Drummond Light is 1,500 times stronger than burning gas; the Gaudin Light is as strong as that of the sun, or 30,000 times stronger than gas.

Chinese shipping, or junks, are curiosities in forms and colours. Arabian vessels were found in all the Eastern Seas, when first visited, just in the fashion of the age of Nearchus.

The French are the most scientific ship-builders in Europe. American ships are remarkable for their elegance, inside and outside. The engineering department gives England the preference in steam-ships, but America carries all the mechanic arts to the highest perfection.

The fixed rates by Government-steamers are—Falmouth to Oporto, or Lisbon, 12*l.* cabin, and 6*l.* 10*s.* steerage. Cadiz, or Gibraltar, 17*l.* and 9*l.* 10*s.* Malta, 29*l.* and 16*l.* Corfu, 36*l.* and 20*l.* Malta to Alexandria, 6*l.* and 4*l.* Jamaica to Barbadoes, or St. Thomas's, 15*l.* and 8*l.* Children under 3 years, gratis; under 9, as steerage; 400 lbs. luggage.

In sailing-packets, Falmouth to Madeira, 25*l.* and 13*l.* Teneriffe, 27*l.* and 14*l.* Buenos Ayres, 75*l.* and 38*l.* Halifax, 30*l.* and 16*l.* Bermuda, 40*l.* and 21*l.* Barbadoes, &c., 35*l.* and 18*l.* St. Kitt's, 39*l.* and 21*l.* Vera Cruz, 52*l.* and 27*l.* Jamaica, 40*l.* and 22*l.* Vera Cruz to Falmouth, 60*l.* and 30*l.*

Timber freights from Quebec have fallen from 60*l.* in 1818, to 42*l.* and 38*l.* From Memel, 27*l.* to 18*l.* From Petersburg, from 37*l.* to 25*l.* Coals from Shields, 13*l.* to 9*l.* 9*s.* From the Mediterranean, from 5*l.* to 3*l.*

Marine insurances to the East Indies were 12*l.* 12*s.* in war, and now only 2*l.* 10*s.* To the West Indies, 15*l.* 15*s.*, and 18*l.* 18*s.* in war; now only 25*s.* To Constantinople, in 1797, 42*l.*; in 1799, 31*l.* 10*s.*, now only 30*s.* To Oporto, in war, 15*l.* 15*s.*, now only 30*s.* To Hamburgh, 7*l.* 7*s.*, now 30*s.* To Dublin, 5*l.* 5*s.*, now 15*s.*

The simple plan of dividing the hull of a vessel into sections, each of which is completely water-tight, has been long practised by the Chinese; the several water-tight compartments being under lock and key, and appropriated to separate shippers. This mode of giving security has now been introduced into European naval architecture by Mr. Williams, of the Dublin Steam-boat Company.

Egyptian drawings prove that the ancients knew the use of the anchor and capstan, the pulley, and the vice.

Steam Navigation.

There are, in 1840, steam-packets from London once, twice, or thrice a-week, to every port of business on the coasts of the United Kingdom, serving at once for passengers and goods, and superceding sailing-vessels, whether as coasters or traders; and there are others once or twice a-week for passengers and goods, from London, &c to nearly every port on the Continent, from the Baltic, North Sea, Atlantic, and Mediterranean, besides

others to the United States, West Indies, &c. In fact, this species of intercourse is now without limit, and every year will add to the variety and competition. The great ports, as Liverpool, Bristol, &c. send forth their shoals to all the ports in their vicinity. Many are conducted by companies with great science and respectability, and with such regularity, that departure and arrival of a steam-vessel may be reckoned on with the same certainty as a stage coach, at a pace which averages 12 miles an hour, and with every luxury of a private dwelling. London has offices in all parts, and Thames-street East, &c. abound in them.

It is, in fine, to be remarked that, in every sense, steam, applied to direction of locomotion, will prove of greater importance to us and to all nations than its past application to manufactory. It will even be many years before all its applications are developed. Horses, roads, canals, wind, tides, &c. must all yield to it; and it will *horizontally* connect the surface of our planet, as intensely as the two motions connect every part *perpendicularly*.

The immense distances in Asia and Africa will for ages (if ever) deprive those countries of the benefits of railways and steam navigation. Even in our Indian territories the distances are often 1300, 1400, and 1500 miles; and, in China and Central Asia, these distances are doubled. Wooden rails may remove obstacles, but the combinations are too numerous, and the manners and policy of people too varied, for extensive and desirable communications. At present, also, projectors look to profits, and many chances must concur before governments form railways with prospective advantages.

The first steam-vessel in Europe was the Comet on the Clyde, and there are now 76 on that river with nearly 8000 tons.

The United Kingdom and Colonies have about 630 steam vessels, in 1840, whose tonnage is about 71,000.

The Great Western steamer, built at Bristol in 1836, is 236 feet long, with breadth 35 feet 4 inches. Draught, loaded, 16 feet. Tonnage 1340 tons. Diameter of paddle-wheels 28 feet. Consumption of coals, (Bristol to New York) 452 tons. 4 boilers, each 1750 cubic feet. Power of engines 450 horses. Weight of engines, boilers, &c. 380 tons. In the expansive use of the steam the supply from the boilers to the cylinders is cut off, before the piston has finished its movements down and up, so as to accommodate its pressure to the reaction of the atmosphere. She makes the Atlantic voyage with precision in 13 to 15 days.

Two barrels of resin are equal to one ton of coals, and hence, at the same expense of fuel, the *Great Western* performed nearly double the work of the *Sirius*.

The *British Queen*, built for the British and American Steam Navigation Company, is the largest vessel ever launched. The length from figure-head to taffrail is 275 feet, being about 35 feet longer than any ship in the British navy. The engines are two of 250 horse power each, with cylinders 77½ inches diameter, and 7 feet stroke; diameter of paddle-wheels, 30 feet. Her computed tonnage is 1,862 tons. The outward voyage in 18 days, and the homeward in 12, consuming 540 tons of coal out, and 360 home.

The voyage from New Orleans to Louisville is now performed in ten or twelve days, formerly three months.

The Americans burn pine-wood in their furnaces, and try anthracite. England alone has the advantage of bituminous coal. 2¾ cords, of 128 cubic feet, is equal only to a ton of coals, at double its price.

Many American steamers on rivers are as large as the Great Western, with powers from 800 to 1500 horses, and a regular pace of 16 miles an hour; but some of them use high-pressure engines with 130 to 150 pounds to the square inch! They have about 600 steamers with 150,000 tons burthen.

A Dublin steam-packet, built of iron, weighs 180 tons, burthen 281 tons, with 63 inches water-way.

It requires an engine of 200-horse power to propel a steam-vessel of 500 tons, and a 300-horse power for one of 1200 tons. The paddle-shaft should be 2-5ths from the head. Short beam-engines working over the crank are preferred; but more subject to accidents than long beams. Delivering-valves and pipes should be larger than the suction and delivering-valves. The pipes should be protected by yarn and canvas. The iron of the boilers should be of the best temper, and the flues of charcoal iron. The surface of water should be 2¾ feet per horse power. Hall's patent condensers return the steam as water at a high temperature. The outsides of boilers usually give way before the inside, owing to bilge-water. Paddles only require to be oblique when the vessel is stationary. As coals diminish, the tanks should be best filled with sea-water. The consumption of the best coals is 8 lbs. per horse power per hour, so that in 466 hours it would be 466 × 300 × 8 = 500 tons nearly. A 300-horse power engine weighs 320 tons, and the stores for 19 days, 50 tons, leaving 330 for passengers, &c. &c. Every horse power is equal to 4 tons, in the best vessels and best construction.—*Russell.*

Junius Smith estimates that one steamer would perform the annual work of 8 sailing-vessels, with a saving of 3000*l.* in expenses.

A steam-vessel, of 2,500 tons, will have, deducting engines, &c., 1600 tons register, or 2400 tons measurement of 40 cubic feet.

Modern steam-vessels are, in length, six times their width, or twelve times their depth.

The Osprey, of 377 tons, the property of the British General Steam Navigation Company, in 51 voyages between Bristol and Dublin, the average consumption on each voyage was 26¼ tons of coals. The number of hours the fires were burning was 32, and the consumption of coal 17 per hour. The length of the passage from 22 to 26 hours.

75-feet keel and 6-feet beam is the best form for quick sailing steam-ships. It enters smooth water without ruffling the surface.

A steam-vessel of 450 tons and 100-horse power, with duplicate parts, costs 18,000*l.*

The ordinary working speed of the best class of steam-boats on the Hudson is 14 miles per hour, *through still water of depth.*

An *iron* ship was launched in Liverpool. With the exception of her decks, she is entirely of iron; she is 270 tons, 24 ft. 6 in. breadth of beam, 13 ft. 10 in. depth of hold, 96 feet keel, and has 99 ft. 9 in. for tonnage. In the water, she floats like a cork.

The *Rainbow*, built at Birkenhead iron-works, Liverpool, is a large iron steamer of 580 tons, 190 feet between the perpendiculars, 198 on deck, and 25-feet beam between paddle-boxes, and 180-horse power. She plies between London and Antwerp, and has made the trip in 16 hours and 50 minutes.

The *Steam Frigate Gorgon*, in an experimental cruise, attained a velocity of 11½ miles per hour, and yet, with this speed, there was not the least sensible vibration on board. The consumption of fuel, ascertained by weighing, was 1 ton of Welsh coals per hour, equal to 7 pounds per horse, per hour, at full speed.

Arrangements have been completed for establishing three steamers, between Boston and England, of 1,000 tons each, and the British government have contracted, for 8 years, to pay the proprietors 270,000 dollars every year for the mails in these ships.

Tabular statement of the comparative dimensions and capacities of the three first American steam-ships.

	British Queen.	*Liverpool.*	*Great Western.*
Extreme length	275 ft.	223 ft.	236 ft.
Breadth within paddle-boxes	37½	30⅚	35½
Tonnage . .	1,863	1,149½	1,340
Horse-power.	500	468	450
Diameter of cylinder . . .	71½ in.	75 in.	73½ in.
Diameter of paddle-whls.	30 ft.	28½ ft.	28¾ ft.
Extra weight: engines, boilers, &c. water	500 tons	450 t.	480 t.
Ditto, coals	600	600	600
Ditto, cargo	500	250	250
Draught of water. . . .	16 ft.	16½ ft.	16¾ ft.

Materials have been shipped for the construction of three iron steam-boats, in large pieces of plate-iron, riveted together, each forming a section or portion of the respective boats for which it was moulded or fashioned, so that the whole may with facility be put together on arrival at Monte Video. The plates are from a quarter of an inch to three-eighths in thickness; the engines from 23 to 39 horse power.

The East India Company's steam-ship, the *Queen*, is intended to navigate the E. Indian rivers. She is 230 feet in length, 29 feet in breadth, exclusive of the paddle-boxes, and 800 tons burden.

The largest iron sailing-ship is now building in Aberdeen. Length of keel, 130 feet; breadth of frame, 30 feet, depth of hold, 20 feet; length over all, 137 feet; tons register, 537.

In June, 1819, the *Savannah*, of 350 tons, came from New York to Liverpool by steam. Since then, or in 1840, we have a dozen great steamers passing between Bristol, Liverpool, and the United States, with regularity, in 12 or 15 days.

Hogg, of the Bahiana steam packet, in Dec. 1838, made a passage in 20 days, from Cork to Pernambuco, stopping at Funchal and Bona Vesta.

In fact, marine engines turn upside down all our past systems of naval tactics; and, however humiliating to proud admirals, &c. the strength of a navy will henceforward depend on steam-vessels of 3 or 400 tons, which are quite independent of wind, and to which larboard and starboard, leeward and windward, are indifferent. In 1839-40, Russia, France, &c. are building steam-ships in British dock-yards, with British engines.

Railways.

List of Railways to Jan. 1, 1839.

Capital in joint stocks.....	£41,510,814
Power to raise by loan ..	16,177,630
Total.....	£57,788,444

In all 102 separate concerns.

Arbroath and Forfar.—Total 46,000*l.*
Avon and Gloucestershire.—Total 105,000*l.*
Aylesbury.—Total 66,000*l.*
Ballochney.—Total 38,431*l.*
Belfast and Cavehill.—Total 38,700*l.*
Birmingham and Derby Junction.—Total 830,000*l.*
Birming. and Gloucester.—Tot. 1,266,666*l.*
Birmingham, Bristol, and Thames Junction.—Total 200,000*l.*
Bish. Auckland & Weardale.—Tot. 96,000*l.*
Blaydon, Gateshead, &c.—Total 80,000*l.*
Bodmin and Wadebridge.—Total 35,500*l.*
Bolton and Leigh.—Total 126,500*l.*
Bolton and Preston.—Total 506,500*l.*
Brandling Junction.—Total 336,000*l.*
Bridgend.—Total 10,000*l.*
Bristol and Exeter.—Total 2,000,000*l.*
Bristol and Gloucestershire.—Tot. 77,000*l.*
Canterbury and Whitstable.—Tot. 80,000*l.*
Carmarthenshire.—Total 18,000*l.*
Cheltenham and Great Western Union.—Total 1,000 000*l.*
Chester and Birkenhead.—Total 330,333*l.*
Chester and Crewe.—Total 333,333*l.*
Clarence.—Total 500,000*l.*
Coleorton.—Total 31,000*l.*
Commercial.—Total 800,000*l.*
Cork and Passage.—Total 266,000*l.*
Deptford Pier Junction.—Total 80,000*l.*
Dublin and Drogheda.—Total 800,000*l.*
Dublin and Kingstown.—Total 270,000*l.*
Duffryn Llynvie.—Loan 12,000*l.*
Dulais.—Total 14,000*l.*
Dundalk Western.—Capital 100,000*l.*
Dundee and Arbroath.—Total 140,000*l.*
and Newtyle.—Total 170,000*l.*
Durham and Sunderland.—Total 256,000*l.*

Durham Junction.—Total 130,000*l.*
Eastern Counties.—Total 2,133,333*l.*
Edinburgh and Dalkeith.—Cap 133,053*l.*
Edinburgh and Glasgow —Total 1,200,000*l.*
Edinburgh, Leith, and Newhaven.—Total 140,000*l.*
Exeter and Crediton.—Total 47,000*l.*
Festiniog.—Total 46,185*l.*
Forest of Dean.—Capital 125,000*l.*
Garnkirk and Glasgow.—Total 148,195*l.*
Glasgow, Paisley, and Greenock.—Total 533,333*l.*
Glasgow, Paisley, Kilmarnock, and Ayr.—Total 833,300*l.*
Grand Junction.—Total 1,906,000*l.*
Great Leinster and Munster.—Total 1,065,000*l.*
Great North of England.—Total 1,150,000*l.*
Great North of England—Clarence and Hartlepool Junction.—Total 70,000*l.*
Great Western —Total 3,333,333*l.*
Hayle.—Total 80,000*l.*
Heckbridge & Wentbridge.—Tot. 21,700*l.*
Hereford.—Total 35,000*l.*
Hull and Selby.—Total 533,333*l.*
Kenyon and Leigh —Total 31,250*l.*
Kilmarnock and Troon —Capital 40,000*l.*
Lancaster and Preston.—Total 333,000*l.*
Leeds and Selby.—Total 340,000*l.*
Leicester and Swannington.—Tot. 175,000*l.*
Limerick and Waterford.—Total 600,000*l.*
Llanelly Railway & Dock.—Tot. 270,000*l.*
Liverpool & Manchester.—Tot. 1,465,000*l.*
London and Birmingham.—Tot. 4,500,000*l.*
London and Brighton.—Total 2,400,000*l.*
London and Croydon.—Total 575,000*l.*
London and Greenwich.—Total 733,333*l.*
London & Southampton.—Tot. 1,860,000*l.*
London Grand Junction.—Total 800,000*l.*
Manchester and Birming.—Tot. 2,800,000*l.*
Manchester and Leeds.—Total 1,733,000*l.*
Manchester and Oldham.—Total 95,000*l.*
Manches., Bolton, & Bury.—Tot. 650,000*l.*
Maryport and Carlisle.—Total 240,000*l.*
Midland Counties —Total 1,333,000*l.*
Monkland & Kirkintilloch.—Cap. 20,000*l.*
Nantle.—Loan 20,000*l.*
Newcastle and Carlisle.—Total 750,000*l.*
Newcastle and N. Shields.—Tot. 160,000*l.*
Newtyle and Coupar Angus.—Tot. 35,200*l.*
Newtyle and Glammiss.—Total 26,600*l.*
Northern and Eastern.—Total 1,600,000*l.*
North Midland.—Total 2,000,000*l.*
Paisley and Renfrew.—Total 33,000*l.*
Polloc and Govan.—Total 66,000*l.*
Preston and Longridge.—Total 40,000*l.*
Preston and Wigan.—Total 333,000*l.*
Preston and Wyre.—Total 170,000*l.*
Rutherglen.—Total 20,000*l.*
St. Helen's & Runcorn Gap.—Tot. 220,000*l.*
Saundersfoot.—Total 25,500*l.*
Sheffield and Manchester.—Total 706,000*l.*
Sheffield and Rotherham.—Total 130,000*l.*
Sheffield, Ashton-under-Lyne, and Manchester.—Total 933,000*l.*
Slamannan.—Total 135,000*l.*
South-Eastern.—Total 1,850,000*l.*
Stockton and Darlington.—Cap 100,000*l.*
Stratford and Moreton.—Loan 10,000*l.*
Taff Vale.—Total 400,000*l.*
Taw Vale (Railway & Dock.)—Tot. 20,000*l.*
Thames Haven —Total 600,000*l.*
Ulster —Total 800,000*l.*
Warrington and Newton.—Total 93,000*l.*
Whitby and Pickering.—Total 135,000*l.*
Wigan Branch —Total 87,500*l.*
Wishaw and Coltness.—Total 80,000*l.*
York and North Midland.—Total 493,333*l.*

The Seventeen following were finished in the Autumn of 1839, *and in use.*

Derby and Nottingham.
Grand Junction.
Leeds and Selby.
Leicester and Swannington.
Liverpool and Manchester.
London and Basingstoke.
London and Birmingham.
London and Greenwich.
London and Croydon.
London and Rumford.
London and Twyford.
Manchester and Littleborough, 16 miles
Newcastle and Carlisle.
North Union.
Southampton and Winchester.
St. Helen's, Runcorn Gap.
Stockton and Darlington.

31 others are in progress, and will be finished in 1840.

$7\frac{1}{2}$ per cent., in railway property, is equivalent to 5 per cent. on real security; hence, at $7\frac{1}{2}$ per cent. profit, shares are at par, but, at 10 per cent., are equivalent to 133*l.* 6*s.* 8*d.* per share. Profits of 15 per cent. raise 100*l.* shares to 200*l.* It is the same with the other contingent property.

About 34 of these concerns bear prices on their shares—the Liverpool and Manchester 194*l.* for its 100*l.* payments; the Grand Junction, 204*l.*; and the Birmingham, 168*l.*

Thirty new railway-bills passed the Legislature during the session of 1836. The length is 994 miles, one furlong, 90 yards, and the estimated cost 17,595,000*l.*, or 17,700*l.* per mile; and the annual expense of working and maintenance will be 1,571*l.* per mile. Of the 30, 19 have no tunnels, and 11 have 27, the length of which is 11 miles, 7 furlongs, 35 yards. Of these tunnels 5 are upon the Leeds and Derby, of 3208 yards; 4 upon the Northern and Eastern, 1770 yards; 4 upon the South-Eastern, of 5874 yards; and 3 upon the Ulster, of 1200 yards. Manchester and Leeds has 33 curves in 14 miles, mostly of small radius; 17 have no inclined planes.

There are, in 1840, about 54 railways with steam-carriages in the United Kingdom, extending about 750 miles, and others are in progress, which, before 1845, will make 11 or 1200 miles. Their average speed is from 20 to 25 miles an hour, and as smooth as gliding on water. Iron rails are laid down 60 lbs. to the yard, (but the Liverpool is but 45 lbs.) with bearings 3 ft. asunder.

TREVETHICK, in 1810, made the *first locomotive Steam-engine.* Till his experiment, it had been *imagined* and concluded, that turned wheels would give no locomotion; and this mistake obstructed the introduction of steam-navigation by revolving paddles.

wheels! When Fulton sent the account of his first voyage to the Editor, Lord Stanhope *demonstrated*, *geometrically*, that Fulton's statement must be false.

It was in March 1802, that Trevithick and Vivian took out their patent for locomotion on railways; but their ideas were so imperfect, that, to assure adhesion, they advised that the periphery should be roughened, or armed with nuts, grooves, &c. Blenkinsop varied this, by making toothed-wheels run on rack-work!

The first iron rail-road was laid down at Colebrook Dale, in 1786, drawn by horses. Near Newcastle, there are 250 miles of iron railway above-ground, and nearly the same beneath. In Glamorganshire there are 300 miles, from different coal-works and mines to quays, by horses.

The cost of hauling goods 20 miles an hour, is 1¾*d.* per ton per mile, and of passengers a ⅓ of a farthing per mile.

The cost of carriages per ton per mile, is the 5th of a penny.

The entire cost of conveyance per mile, at 20 miles per hour, is 0·675 pence per passenger, and 2·855 pence per mile per ton for merchandize and coals. The rate of charge is from 1*d.* to 1½*d.* per mile per passenger, 12·37 pence per mile per ton.—*Wood.*

The average weight of a train, Liverpool and Manchester, is 47·2 tons; Stockton, 6·36.

The total cost of the line of the London and Birmingham Railway is estimated at 5,000,000*l.* for 112½ miles, or 44,444*l.* per mile. It passes by Watford, Hemel-Hempstead, Tring, Leighton Buzzard, Fenny Stratford, Bilsworth, Rugby, Coventry, and Stone Bridge, to Birmingham. It passes the highest summit between Birmingham and London, at Tring, where it is 419 feet above the sea. The railway at London is 119 feet, and at Birmingham 387 feet above the sea. The railways pass 7½ miles S. W. of Barnet, 5 S. W. of St. Alban's, 8 S. W. of Dunstable, 4 S. W. of Newport Pagnell, 3 N. E. of Towcester, 4 S. W. of Northampton, 4 N. of Dunchurch, 2 N. E. of Wolverhampton, 10 E. of Shiffnal, 10 E. of Newport, 10 E. of Draytou, 5 W. of Newcastle, 5 E. of Nantwich, 2 W. of Norwich, and crosses the Mersey about 2 miles S. W. of Warrington.

The Liverpool line crosses the road from Birmingham to Wolverhampton 4 miles from the latter town, and then passes by Brewood and Penkridge, and nearly in a straight line to the Liverpool and Manchester railway, about 1½ mile W. of Newton.

The Tunnel, which connects the water level of Liverpool with the Manchester Rail-Road, is 6700 feet long, 22 feet high, and 16 broad, and 4500 pass through rock.

Most railways in America are formed by wooden railways of large scantling. Brunel's Western railway is on this plan of pine rails, and piles of beech 15 feet asunder, and 8 or 10 feet in the original ground. A section weighs 44 lbs. per yard. The width is 7 feet 2½ inches from the centres of the rails. Every mile consumes 420 loads of pine, 40 of beech, 6 tons of iron-bolts, and 30 000 wooden screws. To increase the speed, the driving-wheels, instead of 5 feet, are 8 and 10 feet diameter; or, if 5 feet, make 3 revolutions for every stroke of the piston.

The Kilsby Tunnel cost 300,000*l.*; the extension from Camden Town to Euston Sq 1¼ mile, with the station, cost 380,000*l.*

On the Manchester and Liverpool railway the journey is performed in a train, in about 90 or 100 minutes. The train consists of 20 waggons or upwards, weighing about 4½ tons each: and the consumption of coke is about 1000 lbs., or 33 lbs. per mile, making the third of a pound, or about 5 oz. per ton per mile. The cost of an engine is about 800*l.*; and of one connected with a coach for 12 passengers about 1200*l.* A locomotive engine appears to perform the work of 1500 mail-coaches, or 1500 waggon-horses per day: 800 passengers have been drawn from Manchester to Liverpool in little more than an hour, by the train of one engine.

In 1834, a locomotive cost 900*l.*; in 1836, 1120*l.*; in 1838, 1,200*l.*; in 1839, 1,250*l.*

The railway-carriages have travelled from Manchester to Liverpool in an hour and a quarter, 33 miles. 100 tons is drawn by a single railway-engine from Manchester to Liverpool in an hour and a half, while a stage-waggon would draw but 8 tons the same distance of 30 miles in a day.

The Birmingham railway has 7 tunnels, in all 3¼ miles. The Primrose-hill 1120 yards. The Kensal Green 320 yards. The Watford 1830 yards. The Leighton 272 yards. Weedon 418 yards. Kilsby 2398 yards. Beechwood 300. The Birmingham station is 250 feet above the London. Iron rails for the whole 112½ miles cost 460,000*l.*, for 35,000 tons, and the stone blocks 180,000*l.* for 152,460 tons. The whole cost nearly 5 millions, or about 45,000*l.* per mile. (Interest 250,000*l.*) There are 8 trains per day and 4 on Sundays.

On the Western railroad, the extreme speed has been 45 miles an hour with a load of 15 tons; but, with a load of 50 tons, 35 miles, the gradient 4 feet per mile. On the London and Birmingham, the extreme speed has been 40·9 with load 31½ tons, and 32 miles with a load of 50 tons, the gradient 16 feet per mile. The evaporation 94·85 cubic feet of water, with cylinders 12 inches and 5-feet driving-wheels.

The Great Western required 12 acres, and the earth-work was 1*s.* 7*d.* per cubic yard. Average fares, 2*d.* per mile; and first class, 3½*d.*

On the Southampton, or South-western, the land on the 77 miles cost 260,000*l.*, or treble the estimate. Fares under 3*d.* and 2*d.* Speed, 76½ miles in 3½ hours, or 22 m. per hour.

The Croydon, of 10½ miles, cost 500,000*l.*

The Romford, or Eastern Counties, extends through Chelmsford, Colchester, Ipswich, and Norwich, to Yarmouth.

Fares; London to Birmingham, 30*s.* and 20*s.* London to Rugby, 24*s.* and 16*s.* 6*d.*;

and to Harrow, only 3*s.* and 2*s.* Birmingham to Coventry, 4*s.* 6*d.* and 2*s.* 6*d.*; and to Rugby, 7*s.* and 4*s.* 6*d.*

Soldiers pay 9*s.* 4*d.* from Birmingham to London.

Carriages pay 75*s.* and 55*s.*; horses, 50*s.*

The total cost of merchandize in the Liverpool and Manchester railway is about 2¼*d.* per ton per mile, and of coals, 1¼*d.* per mile. On the canal it is 1½*d.*, but the railway is to the canal as 31 miles to 56; so that the cost is 6*s.* 3*d.* per canal, and 3*s.* 11*d.* per railway, always shorter than canals.

On the Liverpool and Manchester railway, 31 miles are run in 70 or 75 minutes. Birmingham and Liverpool, 97 miles in 270 minutes. And London and Birmingham, 114½ miles, in 300 minutes. Great Western, 24 miles in 44 minutes. The swiftest boats on canals are above double the time.

The fares for passengers on the Liverpool and Manchester railway are 2*d.* and 1½*d.* per mile.

The fares, from Manchester to Liverpool, are 6*s.* and 4*s.*; the rails are 60 lbs. per yd.; the mail-bags are 1½*d.* per mile.

In 280 days, from June, 1838, to March, 1839, 434,225 passengers passed on the Birmingham Railway, producing 262,557*l.*, *i. e.* above 1600 per day, producing about 950*l.* Summer and Autumn is the best season by 50 per cent.

In the same time, 40,369*l.* was received for parcels, chiefly in winter; and 1300*l.* for excess luggage. The weight of goods was 10,417 tons, in 3044 waggons. Up and down nearly equal.

In nearly 18 months of 1837-8, the locomotive or directive power cost 48,000*l.*; the coaching department, 58,000*l.* The engineering, 15,390*l.* The produce of every kind, 270,000*l.*

The railway from London-bridge to Greenwich is a grand viaduct on arches, so as not to interrupt the lines of streets, &c. It is four miles, travelled in twelve or fifteen minutes.

The passengers, carried on Geenwich railway during the Whitsun-week, 1839, exceeded those of any former period. Monday, 35,336, receipts 1,227*l.*; Tuesday, 22,877, and 784*l.*; Wednesday, 10,028, and 343*l.*; Thursday, 4,635, and 117*l.*; Friday, 3,372, and 122*l.*; Saturday, 346*l.*—Total 2,942*l.*

Railways are proposed from Dublin to Belfast, and Londonderry, 166½ miles, with branch, 62 miles; and another from Dublin, by Navan, to Armagh and Enniskillen, about 150 miles. The cost is estimated at from 10 to 12,000*l.* per mile.

The railway from Bruxelles to Antwerp conveys 91,500 passengers per month; and that to Malines 52,680; another has been opened from Ostend to Bruxelles.

Forty-three new railway companies were incorporated in New York State only, in 1836.

In Dec. 1838, 74 railways, of various lengths, were in operation in the United States. Twice as many more were planned and incorporated.

Railway Postage.

The Whig Administration has liberally yielded to the generally-expressed wishes of the nation; and letters to all parts of the United Kingdom are to be forwarded at an uniform postage of ONE PENNY, instead of the usual mean rate of 10*d.* per 100 miles. The facilities to intercourse of all kinds, to trade, commerce, and speculation, will be immeasurably great; and, if 9 times the number of letters are posted, the Post-office Revenue of a million and a half will be equally great. Our Post communication will then be the cheapest in the world

The chargeable letters, per annum, have been about 90 millions. The franked letters 7½ millions. The newspapers about 30 millions. The mean cost, per chargeable letter, has been 9-8ths of a penny; but, of newspapers and franked letters, 0·84 of a penny, of which the expence of transit is 0·28 of a penny, and 0·56 is miscellaneous.

London Postage has been nearly 700,000*l.* per annum; Liverpool, 91,000*l.*; Dublin, 70,000*l.*; and Edinburgh and Glasgow but 43,000*l.* each. The whole revenue is nearly 1,600,000*l.*

The price for carrying the mails to Birmingham (the 112½ miles in 5 hours by day and 5½ by night) is 28*l.* 4*s.* 4*d.* per day, or 10,340*l.* per year, for a day-mail up and down, and a night-mail up and down. They find large Post-office carriages, carry a guard, and two clerks to sort on the journey.

The weight of the Edinburgh mail in 1837 was about 4 cwt. 2 qrs. 23 lbs. 13 oz., and made up as follows:—

	cwt.	*qrs.*	*lbs.*	*oz.*
Sacks and bags	1	0	9	8
2296 newspapers	2	2	3	8
2 stamp parcels	0	1	12	0
484 franks............	0	1	19	15
1555 chargeable letters	0	1	6	14
	4	2	23	13

The Louth mail, 1 cwt. 1 qr. 27 lbs. 12 oz., was made up as follows: viz.—

	cwt.	*qrs.*	*lbs.*	*oz.*
Bags	0	0	25	0
866 newspapers	1	0	14	0
108 franks............	0	0	8	12
365 chargeable letters	0	0	8	0

The 1555 Edinburgh letters, weighing 34 lbs., cost in conveyance ⅜*d.* each; and the 365 Louth letters, weighing 8 lbs., rather more than 1½*d* each. The postage was 13*d.* and 10*d.*!

Railways convey the mails under an Act, and make two deliveries per day.

The India mails now pass by Marseilles and Malta, and reach Bombay in about 50 days, and Calcutta within 60 days; the distance 5238 miles; while by Falmouth it is 6310, and by the Cape 10,580. From Cairo to Suez is 80 miles, by dromedary in 3 days.

The Menai bridge is 1600 feet long, 30 feet wide, and 100 feet above the water The weight suspended is 343 tons, and the power 2016 tons. The water-way is 500 feet.

A wooden bridge of 1 arch, 980 feet span, has been erected at Petersburgh.

A suspension-bridge at Freyburg, the longest in the world, was completed in 1834. Its dimensions, compared with those of the Menai, are

	Length.	Elevation.	Breadth.
Freyburg ..	905 ft.	174 ft.	28 ft.
Menai	580	130	25

It is supported on four cables of iron wire, each containing 1,056 wires, the united strength of which is capable of supporting three times the weight which the bridge will ever be likely to bear, or three times the weight of two rows of waggons, extending entirely across it.

A new suspension-bridge over the Danube, between Buda and Pest, will be 1600 feet. There will be three openings; the middle passage being 640 feet in width, and those at the sides 270 feet.

Edward's Bridge, over the Taaf, is 140 feet span, 35 high, and 8 broad.

The great causeway of the Incas from Quito, through Cusco to La Plata, in south lat. 19° 40′, nearly 2000 miles long, still remains in parts, with ruins of great buildings near it, and is one of the greatest monuments. It may be questioned, whether it was not constructed by an extinct race, who once flourished in America.

Commercial navigation through the Frozen Ocean, north of America, is proved to be utterly hopeless by all the late abortive expeditions. A loose outline has been obtained of the 103 degrees of longitude, of which the whole coast consists; but the fact is a barren one. Even the Northern coast of Asia would be more promising than America for navigation to India, but for N. E. Cape, in 78½°.

The Desert of Sahara extends over 1,200,000 square miles, and is still extending. Adams and Riley travelled with camels 29 days across one side of this desert, like a sea, without seeing either trees, shrubs, grass, or human being. African and Arabian caravans travel from 18 to 22 miles per day, for months. The burden of the camels is from 500 lbs. to 1000 lbs.

The Breakwater at Cherburgh is near 2000 toises, or 2½ miles long, having entrances near the Pelee Island and Point Querqueville. There is also a new dock, &c. excavated in the rock, near Fort Homet. It cost Napoleon nearly 3 millions.

Mount Cenis, since its improvement by Napoleon-le-Grand, is annually traversed by 17,000 vehicles and 48,000 horses and mules.

Quarantine, owing to new views of contagion, is, in the United Kingdom, reduced to 10 or 15 days, and in some cases to 3. Separation of convalescent from healthy persons is 20 days.

Principles of Power.

The steam-engine, which confers on a piston the directive power of any number of horses, (or 5 times their number of men,) is the machine of power which has raised modern nations above their ancestors. Whoever invented it, it is now altogether English, and made what it is by our mechanics, and by successive additions to its facilities by Savory, Newcomen, Watt, and others. The Marquis of Worcester published mere projects, many of them very wild and absurd. As to the origin of steam-navigation and circular paddles, the Editor has seen an engraving of circular paddles, worked by oxen in an horizontal wheel, in a foreign book of 1510; and, with regard to the substitution of steam for oxen, it is not to be questioned that *Blasco de Garay*, a Spanish Captain, in 1543, made and exercised a *steam-vessel* in the port of Barcelona; but laid it aside, owing to the bigotry of an imperial officer. The French refer the developement of the principle of gaseous expansion to *Salomon de Caus*, of Frankfort, in 1615.

The Mule, invented by Crompton in 1775, has now superseded the Jenny of Hargreave, of which it is such an extension, that 500 or 1000 spindles may be worked by it, and the finest weft be produced. Crompton called his machine a *Mule*, because Arkwright's spinning-frame used to be worked by a *Horse* wheel, and it is intermediate between that and the *Jenny*. The number of mule spindles is estimated at 8½ millions in Great Britain.

All the manufacturing machinery are varieties of the mechanical invention of Androides. Wheel-work, levers, straps, cranks, stops, &c. are made to act by directive powers of steam, water, or wind. The inventions of Hargreave, Arkwright, Watt, Crompton, Cartwright, Fulton, Stanhope, Babbage, Brunel, Stephenson, &c. &c. are mere new applications of varieties of movements, long practised by chronometer-makers and mill-wrights, and mostly known to Archimedes, Hero, Bacon, Albertus Magnus, and the men who by the ignorant monks were called necromancers.

In all cases, steam, &c. are to be regarded as directive power, at right angles to weight and mundane central force.—*Phillips.*

Mr. W. Duke, of Oxford, proposes condensed air as a power, instead of steam, and the idea is reasonable.

A new mechanical power, called the *Turbine*, acting by an arranged fall of water, with a directive power of 40 horses and more, has been invented by M. Fournayron, of Paris, and, at this time, claims the special attention of all engine-makers and engineers. It appears, in fact, to deprive steam of its preference in manufactories, &c.

On a well-constructed railway, a ton is drawn by a force of 7½ lbs., whether the force be derived from steam, or from a weight acting over a pulley. Hence, a force of 25 lbs. would draw a stage-coach with its luggage and passengers, which usually weighs about 3 tons.

An engine costs 550*l.* and the tender 50*l.*; and every 5 engines requires a spare one. The repairs in constant work are about 160*l.* The coals are 382 tons for 312 days, and wages, &c. are about 100*l.* per annum.

The power of engines weighing 8 tons, water and fuel 2½, is equal to 10 horses at 10 miles an hour, and capable of conveying 13 tons of goods, besides 6½ of waggons. The cost is 0·2787 penny per ton per mile, 12 miles an hour.

The Liverpool and Manchester has 123 engines of 1254 horse-power, and each will work 20 years.

The speed of a steam-vessel is the area and speed of the floats by the area of the midship section of the vessel. In a vessel of 550 feet section, if the area of the floats is 1746 feet, moving 16 revolutions per minute, then 29,760 yards per hour gives 17 miles. This reduced to a mean, and allowing for resistance, is about 10 miles an hour.

MR. RENNIE has constructed a steam-vessel to act by the Archimedean Screw. The length of the stroke is 3 feet. The power is estimated at 90 horses. The motion is given to the cranks by means of double side-rods, the joint length of which is 8 feet. The screw is made of plates of iron fastened to arms of wrought-iron, keyed upon a wrought-iron shaft, and when the engine is at work makes 4½ turns for every complete revolution of the shaft-crank. The weight of the engines, and boiler, chimney, coal-boxes, driving-machinery, &c. is 64½ tons. On a trial in the Thames, the speed by the log was 8½ miles.

Railways have been constructed at light expense in very hilly countries, by inclined planes with fixed engines, to raise and lower the carriages from one level to another.

The conveyance of coals, once the chief business of canals, is now effected by railways direct from coal-pits to places of consumption. There are already 15 or 16 such, from 5 to 15 miles long, and they lower the price of coals from 20 to 30 per cent.

On the Great Western Railway, 675 passengers, besides two stage-coaches and three horses, have been directed in one train; also, 617 passengers, nine coaches, and fifteen horses, to Maidenhead, in less than one hour; and 657 persons, five coaches, and fourteen horses by another.

To avoid the immense expences of viaducts, embankments, and removals of streets, Sir R. Phillips proposes suspension-roads, 10 feet above the house-tops, with inclined planes of 20° or 30°, and stationary engines to assist the rise and fall at each end. Cities might be traversed, in this way, on right lines, with intermediate points for descent and ascent.

In the abstract, intercourse of every kind is motion at right angles to the law of central force produced by the two motions of the earth; and, whatever its form or results, the motion is produced by some energy or counteraction of wind, water, gas, steam, &c. to the central force. The object is, to apply such a directive force as shall be greater than half the square-root of the general central force into the actual weight of the body to be moved. In some cases, as in balloons, the central force is negative, and to be added to the directive force; hence, a velocity of 50 miles on a wind of six miles an hour, &c. &c.—*Phillips.*

Persons employed about steam-engines, usually ascribe some occult power to be in the steam; but, there is no power in the steam, and it is merely a means of directing certain apparatus into force in a line of desirable motion. The *expansion* of water by heat lifts the piston, and *condensation* lets it fall again. There are varieties, but the principle is constant. The piston-rod is then the mover and director of wheels acting in the direction desired, *i. e.* turning the paddle-wheels, or forcing round the main wheel of the engine.

A horse, in drawing 2½ miles an hour, has a force of about 128 pounds, and will draw 2½ miles per hour, on a railway, 14 tons; but, at 12 miles an hour, only 3 tons.

A horse-power requires from 5 to 7 gallons of water per minute for condensation of the steam.

The adhesion of iron bars sliding on one another, is 1-7th of the weight, but in a locomotive engine it is 1-15th, and is less as the plane rises. To create adhesion, engines have been raised from 5 or 6 tons to 10 or 12, of which 2-3ds, or 8 tons, are on the drawing-wheels, the 15th of which is 1200 pounds, and this, by 9 pounds per ton, gives about 133 tons for the power of traction. If the wheels are coupled, the whole weight would give 200 tons of draft.

To convey 180 passengers 240 miles in 24 hours, by coaches, would require 12 coaches with 15 passengers each, and 1200 horses; but one locomotive engine does the same in 12 hours, and, therefore, is equal to 1200 horses. If the coaches, as the mail, took but 6 passengers each, they would employ 3000 horses, and the engine in its two trips is equal to 6000 horses.

Taking the gravity, or weight to be overcome, at 9 lbs. on a level road, the friction on an inclined plane of 7 feet per mile of 5280 feet, or 1 in 750 feet, is 2·2 lbs; in 16 feet, or 1 in 330, is 6·8; in 21 feet, or 1 in 250, is 9 lbs. or double; in 66 feet, or 1 in 80, is 28 feet, or quadruple, and the limit of advantage. In 106 feet in 5280, or 1 in 50, it is 45 lbs., or 6 times that on a level.

The gravity of carriages is taken by engineers to be the same at all velocities. On a railway it is 1-250th of the load, so that 2240, the pounds in a ton, gives 9 pounds; but it is usually taken as 10 pounds, or the 224th, as the mean of all weathers; or by others at only 8 pounds, or 7½ pounds, that is, at a 280th or 300th of the load. Some models have even given but 3, 4, or 5 pounds.

On a railway, on a declivity 1 in 139, the uniform velocity is double that in the horizontal; 1 in 695 is a fifth more when uniform. Between 695 and 139 requires adjustment of the steam, and where more than 1 in 139, the brake is necessary.

Trials have been made at Woolwich with prepared fuel, for the use of steamers. It is a composition of screened (otherwise almost useless and small) coal, river-mud and tar, cast into brick-like moulds.

Every railway, to attain a level, consists of cuttings down and embankments raised, with viaducts, when the embankments are not practicable, or rivers or roads intervene.

To comprehend the advantages of a level rail-road, whose gravity is 9 lbs. and friction 0, the gravity on a gravel road being 9 lbs., the friction is 138 lbs., and on a macadamized road is 9 lbs., and 37 lbs. for friction; and even on a smooth pavement is 9 lbs., and 24 lbs. for friction; when broken stones are first laid, the friction is 220 lbs.

In a locomotive steam-engine, the power is governed by the diameter of the cylinders, the pressure of the steam, and the length of the stroke of the piston; and this power, divided by 8, 9, or 10, gives the tons which the engine can draw. But the absolute power of an engine is its velocity, and a rate of 15 miles an hour being taken as 20 horses, 30 miles is called a 40-horse power.

Improvements raise the cost of railways to 20,000*l.* or 25,000*l.* per mile.

The direct expenses of conveying loaded coals or minerals, by railway, is about 1*d.* per ton per mile.

Light goods, says Wood, are conveyed on railways, with locomotive engines, at 1-8th of the *cost* of roads, and 3 times the speed; and passengers and parcels at 1-14th, with double speed.

COMMERCE.

In the present articles we have adopted the Parliamentary Returns, as briefer and more correct than any other form of information; and we owe them to the more liberal spirit of modern parliaments.

Foreign trade is salutary only, when kept by the state within its object of importing desirable foreign products, in exchange for superfluous native ones; and it ought to be controlled, when its transactions interfere with native wealth and home industry. It is advantageous to those concerned in it only, when supply follows demand. But, when supply precedes demand, and goods are sent on speculation, prices are unduly lowered, the exporter is ruined, and the trade disturbed or destroyed. Our external commerce began with the first system, and has proceeded in the ambition of speculation to the last.

What we grow ourselves is wealth, abating the cost of production. What we manufacture is wealth, abating the cost of the raw material;—but what we import and export is wealth only on account, in which cost of material, charges, risk of debts, machinery, and labour, are essential ingredients, and may or may not be wealth.

Shipping, the commercial test in an island, is not so in nations in juxtaposition. Thus, France carries on an immense unseen trade with Spain, Italy, Belgium, Switzerland, and Germany. And Russia, with its thousand miles of frontier, may, unseen, carry on half the interchanges of the world.

The Sampson's Hair, or Strength of England, was exposed, when, after the Peace of 1814, foreigners were admitted to see all our manufactories. The hair was shorn when a law was passed to permit the exportation of machinery; and when the raw material, as yarn, &c., were permitted to be exported.

In all external trade, the exports and sales are the *receivable* accounts; and the imports or purchases are the *payable* accounts. Balances of a nation with particular nations are against or for, as they are producers or consumers; and, every nation has its own set of accounts with other nations, *pro* and *con.*; but if any nation imports and consumes more than it has to export in exchange, it is like a trader who buying more than he sells, must, in time, become bankrupt.

If it export more than it import, the balances must be receivable in money; but, if it imports more than it exports, the balance must be paid in bullion, or specie, as has been our case, for two or three years past.

Increasing luxury is one cause of adverse balances, for, in 1814 and 1816, the imports retained for home consumption were but 14 millions, while for several late years they have been 38 millions.

The balance of trade is in favour of every country, or the merchants must in time retire from it. If against England with A, B, and C, it is in favour from D, E, F, G, H, and so it is with all nations. It is with a nation as with an individual. It is against him with his baker and wine-merchant, but in his favour with others, or he could not pay the baker and wine-merchant. The balance began to turn against our manufactures, *i. e.* the ratio of quantity rose above the ratio of real value, after the Milan and Berlin decrees, when it became necessary to smuggle, or export by circuitous means.

It will be seen, by the following general Lists, what are the articles which command the foreign sale of millions, *seven* in number; and of half millions other *seven* in number. These alone give name and character to the manufacturing system. But the tenure in them must be short, if the United States, France, Prussia, Russia, Switzerland, &c. continue, for the next 10 years, the activity of the last seven.

The nurseries and perpetuators of our trade have been the great commercial companies. Individuals cannot afford the risks of foreign enterprizes, and delays of return in untried markets. They are usually too anxious after immediate advantages, and they compromise profits by the fatal error of making supply precede demand. The epoch of commercial profits and mercantile wealth in England was when nothing was exported but to order, or to meet known periodical demands. The scramble among needy exporters into foreign markets, has been more ruinous to all concerned than the scramble to undersell among shopkeepers in London and country towns.

For particular branches of commerce, there were a North American Company, Canada, Eastland, Hudson's Bay, Russia, South Sea, and the East India and Turkey

Companies, the operations of which laid the foundation of our commercial ascendancy.

There is a Board of Trade and Colonies, with commissioners, clerks, &c. &c. but none of them are traders.

There are British consuls at 126 foreign ports, or commercial cities, and about the same number from all foreign governments, in the ports and towns of the U. Kingdom.

The following is the number of British Consuls in foreign countries, and the number of vessels, under the British flag, which *arrived* and *departed* in 1832.

Countries.	Consuls.	Vessels.
Russia	7	1,409
Sweden	2	39
Norway	2	52
Denmark (Sound)	2	3,330
Prussia	4	315
Germany	6	930
Holland	2	1,056
Belgium	2	536
France	12	660
Spain	12	143
Portugal, &c.	9	573
Italy	16	713
Greece	4	20
Turkey	10	185
Syria	5	....
Egypt	4	....
United States	10	1,079
Mexico	4	37
Hayti	3	70
Guatemala	1	....
Colombia	6	75
Brazil	6	425
Monte Video	1	30
Buenos Ayres	1	47
Chili	4	51
Peru	3	....
Sandwich Islands	1	27

The official value is a mere guage or ratio of quantity, the values being taken the same in 1840, as in 1694, when fixed. If they were 36 millions in 1817, and 72 in 1840, it shews that, in 1840, we give double the quantities for 42 millions, the amount at real value in 1817 and 1840. This is the solution of the difficulties of the manufacturing classes. We give to foreigners double the weight, measure, and tale, that we gave twenty years ago, and this difference is constantly increasing.

We gave, within 14 years, *above double* in weight and tale for equal invoice amounts!

Years.	*Ratio of Quantity.*	*Declared Value.*
1798	19,672	£33,148,682
1800	24,304	39,471,203
1807	25,190	40,479,865
1814	32,200	43,447,372
1821	40,194	35,826,082
1828	52,029	36,152,799
1830 U.K.	60,492	37,691,302
1834	69,989	39,667,397
1838	92,107	49,640,896

Thus, in weight and measure we exported, in 1798, a quantity expressed by the number 19,672 for 21 millions; in 1821, we exported 40,194 for 36 millions; and, in 1828, 52,029 for 40,194.

Quantities, constantly multiplied by a fixed price, give amounts in the exact ratio of the quantities; and this is the *official value*, as it is ridiculously called. The equivoque has, however, led to mistakes of fatal character, for the ratio of quantity being put as pounds sterling, and these increasing as quantities are increased, owing to reduction of prices, dishonest ministers have thus imposed on ignorant parliaments.

Nor are the declared values absolute criterions, for some merchants undervalue to save charges, and others overvalue to exalt their transactions. Some, also, take the home value, and others the value at the place of exportation!

Values of the Imports into, and of the Exports from, the United Kingdom of Great Britain and Ireland, during the Three Years ending the 5th Jan. 1839.

	Imports into the United Kingdom, taken by the old numeration.	Exports of Produce and Manufactures of the United Kingdom, taken by old numeration.	Exports of Foreign and Colonial Merchandise, taken by the same.	Real or declared value of the Produce and Manufactures of the United Kingdom Exported.
	£	£	£	£
1837	57,230,968	85,229,837	12,391,712	53,293,979
1838	54,737,301	72,548,047	13,233,628	42,069,245
1839	61,268,320	92,459,231	12,711,318	50,060,970

What the Public Returns call official values, was the value in 1696, and a mere numerator or a comparison of weight, measure, and tale now, and in 1696. Perversely, the Imports are given only in this numeration value, and therefore permit no comparison with the Exports. Nevertheless, as 85 official means 53 real, 72 means 42, and 92½ means 50, we may approximate the value of the Exports of colonial merchandise, and also of Imports. It is a Custom-House absurdity.

Numeration Estimates of Imports into Great Britain, in 1838, *in articles taken at above* £40,000.

Almonds	£49,232
Ashes, Pearl and Pot	162,348
Bark for Tanning or Dyeing	121,229
—— Peruvian	47,802
Bones of Animals and Fish	255,967
Borax	67,524
Brimstone	447,614
Bristles	44,394
Butter	365,843
Cassia Lignea	28,549
Cheese	341,984
Cinnamon	80,921
Clocks	34,126
Cloves	45,532

Cochineal, Granilla, and Dust	493,208
Cocoa and Chocolate	93,334
Coffee	2,452,055
Copper Ore	70,781
Cork	41,409
Corn, Grain, &c.	2,369,956
Cottons, India	185,738
—— Europe, &c.	91,968
Currants	177,956
Dye and Hardwoods, Barwood	42,088
—— Fustic	38,810
—— Logwood	198,418
—— Mahogany	220,996
—— Rosewood	20,264
Flax and Tow of Hemp and Flax	3,220,723
Furs	212,865
Gum Animi and Copal	28,402
—— Arabic	51,482
—— Lac of all sorts	145,245
—— Senegal	62,208
Hair or Goats' Wool	39,722
Hemp	601,032
Hides, Raw and Tanned	1,036,225
Indigo	936,453
Iron in Bars	222,416
Lead, Pig	49,982
Lemons and Oranges	52,676
Linens, Foreign	74,442
Mace	16,189
Madder	718,122
Melasses	434,807
Nutmegs	47,818
Oil, Castor	84,026
—— of Olives	260,027
—— Palm	279,721
—— Train, Sperm. and Blubber	512,607
Pepper	61,372
Pimento	24,054
Quicksilver	290,076
Rags, &c.	47,543
Raisins	133,318
Rapeseed and other Oil Cakes	238,506
Rhubarb	74,043
Rice	216,207
Safflower	37,137
Saltpetre and Cubic Nitre	185,197
Seeds, Clover	67,073
—— Flaxseed and Linseed	379,679
—— Rape	92,107
Shumac	65,687
Silk, Raw and Waste	1,688,022
—— Thrown	338,053
—— Manufactures, India	301,454
—— Europe, &c.	739,148
Skins (not Furs)	230,442
Spelter	268,717
Spirits, Brandy	323,485
—— Rum	418,889
Sugar	6,609,422
Tallow	1,137,685
Tar	149,394
Tea	3,976,363
Timber	22,954
—— Deals and Deal Ends	88,198
—— Masts and Spars	80,961
—— Staves	51,430
—— Timber, 8 inches sq. Fir	460,156
—— Oak	49,582
—— Balks, Spikes, Oak Plank, &c.	56,785
Tin	153,609
Tobacco and Snuff	298,942
Turpentine, Common	215,932
Whalefins	84,492
Wines	895,322
Wool, Cotton	16,655,757
—— Sheep's	1,420,112
Woollen Manufactures	235,384
Official numeration of Imports	£59,878,905

Colonial Merchandize Exported at the Official Enumeration of quantities in 1838.

Almonds	£31,165
Ashes, Pearl and Pot	8,325
Bark, Peruvian	15,276
Cinnamon	126,882
Cloves	47,058
Cochineal	376,499
Cocoa and Chocolate	22,895
Coffee	705,601
Cotton Manufactures of India	432,869
Currants	42,294
Hemp	49,314
Hides	128,160
Indigo	985,914
Nutmegs	40,071
Oil of Olives	41,587
Pepper	166,628
Pimento	23,918
Quicksilver	620,398
Raisins	15,867
Rhubarb	52,892
Rice	231,731
Saltpetre	161,987
Silk	154,045
—— Manufactures of India	544,645
Skins and Furs	70,471
Spelter	78,526
Spirits, Brandy	279,575
—— Geneva	131,529
—— Rum	353,576
Sugar	936,437
Tea	386,585
Tin	188,719
Tobacco and Snuff	228,516
Wool, Cotton	2,094,349
—— Sheep'	130,494

Produce and Manufactures of the United Kingdom Exported from Ireland to Foreign Parts.

Bacon and Hams	£3,426
Beef, Salted	2,922
Beer and Ale	5,566
Butter	49,977
Lard	5,478
Linen Manufactures	35,036
—— Yarn	158,271
Pork, Salted	26,995
Spirits	2,927

Ireland exported in beer and ale, in 1837, £6,355; in 1838, £4,887.

Exports from Ireland during Three Years.

Years ending 5th Jan.	Produce and Manufactures of the United Kingdom, Exported from Ireland
1836	£353,141
1837	303,040
1838	420,074

Home Consumption of the principal Articles of Foreign and Colonial Merchandize, in the Year ended 5th Jan. 1839, compared with the preceding Year.

	1838	1839
Barilla . . *cwts.*	91,603	77,759
Bark, Tanners, *cwts.*	788,711	613,743
Butter . . *cwts.*	266,161	252,132
Cheese . . *cwts.*	232,257	219,354
Cocoa-nuts . *lbs.*	1,418,570	1,602,671
Coffee, W. India *lbs.*	17,174,721	15,526,569
— Other sorts *lbs.*	3,169	8,201
Tot. Coffee imported and consumed *lbs.*	26,392,427	25,818,613
CORN :—		
Wheat . . *qrs.*	232,793	1,740,806
Barley . . . *qrs.*	47,475	8,193
Oats . . . *qrs.*	333,933	11,070
Rye . . . . *qrs.*	19,575	2,517
Peas . . . *qrs.*	87,615	11,619
Beans . . . *qrs.*	109,075	54,240
Maize . . . *qrs.*	763	3,124
Buckwheat . *qrs.*	298	174
Flour . . *cwts.*	40,187	392,847
DYES :—		
Cochineal . *lbs.*	154,947	202,086
Indigo . . *lbs.*	2,240,451	3,020,170
Lac-Dye . *lbs.*	427,920	633,861
Logwood . *tons.*	12,355	14,107
Madder . . *cwts.*	79,084	109,385
Madder Root *cwts.*	101,508	83,725
Shumac . . *cwts.*	123,638	208,251
Eggs . . *numb.*	74,790,126	83,817,789
Flax and Tow *cwts.*	1,002,340	1,624,754
FRUITS :—		
Currants . *cwts.*	175,033	166,483
Figs . . . *cwts.*	18,816	16,006
Lemons & Oranges } *chests*	313,647	230,916
Lemons & Oranges } *loose.*	30,547	17,436
Raisins . . *cwts.*	152,639	155,572
Gloves, Leath. *pairs*	1,221,350	1,136,842
Hemp, undr. . *cwts.*	666,997	763,943
Hides, untann. *cwts.*	293,491	318,763
Mahogany . . *tons*	22,958	24,758
Melasses . . *cwts.*	592,575	527,089
METALS :—		
Iron, in bars or unwrought, *tons*	13,470	19,318
Spelter . . *cwts.*	53,946	77,662
OIL :—		
Train . . *tuns*	21,286	28,008
Palm . . . *cwts.*	214,000	276,809
Cocoa-nut . *cwts.*	28,837	38,781
Olive & Paran *gal.*	1,499,103	2,038,028
Opium . . . *lbs.*	37,616	31,204
Quicksilver . *lbs.*	314,036	406,580
Rice . . . . *cwts.*	126,740	138,573
Rice in Husk *bush.*	289,238	290,562
Saltpetre . . *cwts.*	256,872	300,266
SEEDS :—		
Clover . . *cwts.*	124,965	95,882
Flaxseed and Linseed . . *bush.*	3,394,843	3,198,217
Rape . . *bush.*	957,526	713,959
SILK :—		
Raw . . . *lbs.*	3,730,427	3,683,722
Waste, Knubs, & Husks . . *lbs*	875,782	960,128
Thrown, sorts, *lbs.*	213,368	243,569

	1836	1839
Silks, European :—		
Silk or Satin *lbs.*	77,050	117,285
— figured or brocaded . *lbs.*	37,720	70,700
Gauze, plain *lbs.*	1,154	371
— tissue, foulards *lbs*	8,165	16,285
— figured or brocaded . *lbs.*	21,949	10,451
Crape, plain *lbs.*	4,608	2,993
Velvet, plain *lbs.*	15,834	20,554
— figured *lbs.*	1,307	2,074
Silks, India :—		
Bandannoes and Handkfs. *pieces*	134,714	85,478
SKINS :—		
Goat, undr. *num.*	433,686	511,392
Kid, undr. *num.*	217,058	121,664
— dressed, *num.*	720,200	680,831
Lamb, undr. *num.*	1,673,173	1,983,896
— dressed, *num.*	14,212	6,881
SPICES :—		
Cassia Lignea *lbs.*	105,485	100,837
Cinnamon . *lbs.*	14,956	16,688
Cloves . . *lbs.*	87,131	108,103
Mace . . *lbs.*	18,481	20,418
Nutmegs . . *lbs.*	134,115	125,334
Pepper . . *lbs.*	2,626,298	2,635,020
Pimento . . *lbs.*	335,653	339,979
SPIRITS :—		
Rum . . *galls.*	3,184,598	3,135,373
Brandy . *galls.*	1,209,055	1,203,666
Geneva . *galls.*	18,252	18,256
SUGAR, unrefined :—		
Of the Br. Possessions in Am. *cwts*	3,562,779	3,369,035
Of Mauritius *cwts.*	522,361	585,160
E. India, Br. *cwts.*	270,071	418,717
Tallow . . . *cwts.*	1,294,020	1,166,177
Tar . . . . *lasts*	11,744	14,221
Tea . . . . *lbs.*	31,872,635	32,366,412
TIMBER :—		
Battens and Ends *gr. hund.*	14,496	17,708
Deals and Ends B. America *do.*	39,461	41,816
Deal & Deal Ends, other parts *do.*	27,486	29,312
Staves . . *do.*	85,137	76,167
Timber. 8 in. sq. and upw. *loads*	545,370	559,147
From other pts. *do.*	117,439	157,005
TOBACCO :—		
Unmanufac. *lbs.*	22,504,344	23,356,246
Manu. & Snuff *lbs.*	144,959	190,349
TURPENTINE :—		
Common . *cwt.*	405,773	353,642
WINES :—		
Cape . . *galls.*	500,968	538,900
French . *galls.*	459,623	436,866
Other sorts *galls.*	5,604,214	6,225,110
WOOL, COTTON :—		
Brit. E. Indies *lbs*	34,019,419	34,135,861
U. S. Amer. *lbs*	309,027 306	389,579,134
Brazil . . *lbs.*	20,822,509	24,727,312
Egypt . . *lbs.*	7,463,050	4,831,532
Otherwise . *lbs.*	5,645,936	6,320,275
Total of Cotton Wool imported and consumed	378,019,654	460,756,023
Wool, Sheeps' *lbs.*	43,170,136	56,734,625

The Net Receipts from the Customs, in 1838, *in amounts above* £5,000, *were as under.*

Almonds	£6,985
Bark for Tanners or Dyers	17,472
Beer, Spruce	11,243
Books, Foreign	8,162
Brimstone	16,722
Bristles	29,831
Butter	251,665
Cheese	113,903
China-ware, Porcelain, and Earthen.	5,228
Clocks	8,223
Cochineal, Granilla, and Dust	5,058
Cocoa, Cocoa-nut Husks and Shells, and Chocolate	13,719
Coffee	664,748
Cork, unmanufactured	20,960
Corn, Grain, Meal, and Flour	185,096
Cotton Manufactures, not otherwise described	5,694
Currants	183,415
DYE AND HARDWOODS:—	
Mahogany	55,535
Rosewood	10,767
Eggs	29,024
Embroidery and Needlework	8,888
Figs	11,641
Flax, and Tow or Codilla of Hemp and Flax	6,477
Furs	35,991
Ginger, Dry	6,516
Glass; viz. Bottles, Green or Common	15,828
Glass, of all other sorts.	5,000
Gum, Senegal	7,344
Hides, and Pieces of Hides not tanned	41,461
Indigo	38,810
Iron in Bars, or unwrought	27,847
Leather Gloves	21,385
Lemons and Oranges	48,444
Linens	19,529
Liquorice Juice	26,274
Madder and Madder Root	12,954
Melasses	236,433
Nutmegs	15,494
Nuts, Small	15,204
Oil, Chemical, Essential, and Perfumed of all sorts	6,379
„ Olive and Paran	44,912
„ Palm	17,100
„ Train, Sperm. and Blubber	6,592
Pepper	61,162
Platting of Chip or Straw	28,957
Plums dried, French Plums and Prunelloes	5,091
Raisins	113,497
Rape Seed and other Oil Cakes	7,807
Rice	6,962
„ in the Husk	17,639
Saltpetre and Cubic Nitre	7,504
Seeds, all sorts, (including Tares)	132,371
Silk, Raw	15,286
Silk Manufactures, East India	16,573
„ „ France	222,550
Skins, (not being Furs)	17,928
Spirits, Foreign and Colon. Rum	1,402,201
„ „ Brandy	1,334,654
„ „ Geneva	19,211
„ „ of all other sorts	9,769
Spirits of Manufacture of Guernsey and Jersey	£5,158
Sugar	4,261,317
Tallow	173,518
Tar	10,078
Tea	2,956,101
TIMBER:—	
Battens and Batten Ends	160,492
Deals and Deal Ends	607,056
Firewood	7,882
Lathwood	31,410
Masts and Spars	18,876
Oak Plank	15,552
Staves	56,521
Teake	6,553
Timber, Fir, 8 inches square	521,434
„ Oak, ditto	45,939
„ of other sorts, ditto	10,090
Wainscot Logs . ditto	12,215
Tobacco and Snuff	2,795,727
Turpentine, Common	78,918
Valonia	5,212
Water, Cologne	5,077
Wines	1,654,425
Wool, Cotton	557,891
„ Sheep and Lambs'	163,607
Woollen Manufactures, not otherwise described	32,121
Total Duties Inwards	£20,197,997

DUTIES OUTWARDS.

Coals and Culm	7,630
Other Brit. Goods (per centage)	100,139
Total Duties Outwards	£107,769

All duties, £20,421,150.

Duties Inwards, Ireland, above £10,000.

Coffee	£20,232
Spirits, For. and Colonial, Rum	8,865
„ „ „ „ Brandy	18,959
Sugar	395,574
Tallow	10,150
Tea	405,933
TIMBER:—	
Deals and Deal Ends	15,203
Timber, Fir, 8 in. sq. or upwards	51,160
Tobacco and Snuff	766,084
Total Irish Duties Inwards	£1,933,907

The Prusso-Bavarian league, or ZOLL VEREIN, extends over 176,000 square miles, and includes about 26½ millions of people. The scheme has much affected British exports, except in yarns for their own manufactures, leaving to us the poor advantages of being their spinners.

In Saxony, cotton gloves are 9*d.* per dozen pairs, stockings at 3*s.*, and night-caps at 1*s.* to 1*s.* 6*d.* per dozen, aud other articles in proportion!

Germany is the chief foreign market in exchange for manufactured sheep's wool, about 3·3 millions sterling. Italy 2·16. Holland and the United States, 1·7 each. Brazil 1·5. India 1·27. Russia 1·1. Total to all nations nearly 20·5 millions.

Quantities Imported from all Parts, from 1782 to 1838, every 10th Year.

Year.	Cotton Wool.	Coffee.	Flax.	Undressed Hemp.	Sheeps' Wool.	Silk, Raw. Duty paid from 1835.	Silk, Thrown. Duty paid from 1835.	Sugar.	Tallow.
	lb.	cwt.	cwt.	cwt.	lb.	lb.	lb.	cwt.	cwt.
1782	11,828,039	- -	- -	- -	- -	- -	- -	1,374,269	- -
1792	34,907,497	69,029	243,324	614,362	4,513,976	931,894	436,891	1,989,230	201,856
1802	60,345,600	460,544	277,443	488,198	7,749,112	559,729	396,210	4,297,079	556,749
1812	63,025,936	405,745	405,304	852,016	7,014,917	1,330,106	617,885	3,762,182	309,324
1822	142,837,628	44,003,124	610,106	616,454	19,058,080	2,060,292	502,975	3,774,575	805,238
1832	286,832,525	50,225,939	982,516	593,564	28,128,973	3,391,721	177,166	4,867,747	1,177,815
1837	407,268,952	36,401,008	1,002,256	772,315	48,356,112	4,075,352	229,958	4,481,474	1,308,734

AVERAGE *Annual Imports and Exports into and from Great Britain, from and to all Parts, during the undermentioned Periods.*

Years inclusively.	Cotton Wool.		Coffee.		Flax.		Sheeps' Wool.		Raw Silks.		Thrown Silks.		Sugar, Raw.		Sugar Refined
	Imported.	Exported.	Imported.	Exported.	Imported.	Exported.	Imported.	Exported.	Imported.	Exported.	Imported.	Exported.	Imported.	Exported.	Exported.
From—to	lb.	lb.	lb.	lb.	cwt.	cwt.	lb.	lb.	lb.	lb.	lb.	lb.	cwt.	cwt.	cwt.
1793 1798	26,193,700	936,700	42,366,400	31,058,700	294,396	6,747	3,630,900	116,300	653,200	60,400	352,300	27,200	2,324,205	477,200	216,697
1814 1818	111,098,400	8,696,600	73,731,300	84,387,500	406,996	19,225	15,988,700	273,000	1,319,900	122,300	376,000	44,000	3,908,431	714,570	631,407
1828 1832	257,999,400	19,311,500	42,865,200	23,020,500	932,250	9,033	28,767,800	703,800	3,583,900	78,700	388,100	19,230	4,974,885	353,927	515,533
1833 1837	361,692,600	31,013,500	35,029,100	12,537,800	1,042,710	14.757	47,854,400	1,759,300	3,738,900	169,869	252,800	19,502	4,612,322	412,601	294,585

MARKET PRICES OF IMPORTS.
(TOOKE.)

ASHES, BARILLA, per Cwt.

1782 . . . . 22*s.* 0*d.* *a* 24*s.* 0*d.*
1802 . . . . 21 0 *a* 23 0
1822 . . . . 16 0 *a* 17 0
1836 . . . . 10 0 *a* 10 6

ASHES, PEARL, per Cwt.

1782 . . . . 46*s.* 0*d.* *a* 50*s.* 0*d.*
1802 . . . . 30 0 *a* 36 0
1836 . . . . 36 0 *a* 38 0

Coffee, British Plantation, Sup., per Cwt.
1782 . . . 105s. 0d. a 116s. 0d.
1802 . . . 96 0 a 128 0
1822 . . . 120 0 a 140 0
1836 . . . 91 0 a 115 0

Copper, British, in Cakes, per Cwt.
1782 . . . 83s. 0d. a 86s. 0d.
1822 . . . 105 0 —
1836 . . . 103 0 a 105 0

Cotton Wool, West India, Surinam, and Demerara, per lb.
1782 . . . 1s. 8d. a 3s. 0d.
1802 . . . 1 3 a 2 1
1822 . . . 0 8¼ a 1 0½
1836 . . . 0 9¾ a 1 3

Cotton Wool, Bowed Georgia, per lb.
1802 . . . 0s. 10d. a 2s. 8d.
1822 . . . 0 8¼ a 0 10
1836 . . . 0 9¾ a 0 11

Cotton Wool, Pernambuco, per lb.
1802 . . . 2s. 8d. a 2s. 11d.
1822 . . . 1 0 a 1 1
1836 . . . 1 1 a 1 2

Flax, Petersburg, per Ton.
1782 . . . 36s. 0d. a 38s. 0d.
1802 . . . 63 0 a 64 0
1822 . . . 48 0 a 50 0

Hemp, St. Petersburg, Clean, per Ton.
1782 . . . 31s. 5d. a 33s. 0d.
1802 . . . 31 0 a 32 0
1822 . . . 28 0 a 30 0
1836 . . . 27 10 a 28 10

Lead, English, in Pigs, per Fodder 19½ cwt.
1782 . . . £18 0s.
1802 . . . 28 0
1822 . . . 23 0
1836 . . . 27 15

Indigo, East India, Superior, per lb.
1782 . . . 6s. 6d. a 8s. 0d.
1802 . . . 9 0 a 10 6
1822 . . . 8 0 a 10 9
1836 . . . 5 9 a 7 1

Iron, English, in Pigs, per Ton
1782 . . . £6 0s. a £7 10s.
1802 . . . 5 10 a 9 0
1822 . . . 6 0 a 6 10
1836 . . . 8 0 a 10 0

Oil, Gallipoli, in Bond, per Tun 236 galls.
1782 . . . £36 0s. a £37 0s.
1802 . . . 52 0 a 53 0
1836 . . . 58 0 a 59 0

Butter, Waterford, per Cwt.
1782 . . . 56s. 0d. a 58s. 0d.
1802 . . . 65 0 a 70 0
1822 . . . 60 0 a 70 0
1836 . . . 70 0 a 76 0

Rice, Carolina, per Cwt.
1782 . . . 22s. 0d. a 24s. 0d.
1802 . . . 40 0 a 42 0
1822 . . . 29 0 a 33 0
1836 . . . 28 0 a 31 0

Saltpetre, E. I. Rough, in Bond, per Cwt.
1782 . . . 72s. 0d. s. d.
1822 . . . 29 0 a 32 0
1836 . . . 26 6 a 29 6

Silk, Bengal, Raw, per lb.
1802 . . . 5s. 0d. a 30s. 0d.
1822 . . . 15 0 a 25 1

Silk, China, Raw, per lb.
1782 . . . 19s. 0d. a 20s. 6d.
1802 . . . 22 0 a 23 0
1822 . . . 17 7 a 22 0
1836 . . . 21 0 a 29 6

Spices.—Cinnamon, Ceylon, per lb.
1782 . . . 11s. 6d. s. d.
1802 . . . 4 9 a 5 6
1822 . . . 8 6 a 9 0
1836 . . . 8 9 a 9 3

Spices.—Pepper, per lb.
1782 . . . 1s. 10d. s. d.
1802 . . . 1 3
1822 . . . 0 7½ a 0 7⅞
1836 . . . 0 4¾ a 0 5

Spirits.—Rum, Jamaica, Proof, per Gallon.
1782 . . . 3s. 2d. a 3s. 4d.
1802 . . . 5 6 a 6 9
1822 . . . 1 10 a 3 3
1836 . . . 2 9 a 3 10

Sugar, Muscovados, per Cwt.
1782 . . . 40s. 0d. a 63s. 0d.
1802 . . . 26 0 a 50 0
1822 . . . 34 0¾
1836 . . . 38 0¼

Tar, Stockholm, per Barrel.
1782 . . . 23s. 0d. a 24s. 0d.
1802 . . . 20 0 a 22 0
1836 . . . 13 6

Tea, Congou, per lb.
1782 . . . 4s. 6d. a 5s. 6d.
1802 . . . 3 0 a 3 9
1822 . . . 2 6 a 3 9
1836 . . . 1 0½ a 3 0

Tea, Hyson, per lb.
1782 . . . 7s. 6d. a 13s. 6d.
1802 . . . 4 4 a 6 6
1836 . . . 2 8 a 6 2

Timber.—Memel Fir, per Load.
1782 . . . £3 5s. £ s.
1802 . . . 3 12 a 3 14
1836 . . . 3 0

Timber.—Quebec Yellow Pine, per Load.
1802 . . . £4 10s. a £4 15s.
1822 . . . 2 15 a 2 18
1836 . . . 3 10

Tobacco, Virginia, per lb.
1782 . . . 0s. 10d. a 1s. 5d.
1802 . . . 0 3 a 0 6½
1836 . . . 0 3¾ a 0 8

Wool (Sheeps'), Spanish, per lb.
1782 . . . 3s. 0d. a 3s. 6d.
1802 . . . 5 9 a 6 0
1822 . . . 3 6 a 5 0

Vessels employed in the Coasting Trade.

	Inwards.—1838.		Outwards.—1838.	
Between Great Britain and Ireland	10,312	1,264,975	15,908	1,556,216
Other Coasting Vessels	117,859	9,226,777	121,895	9,269,307
Total..................	128,171	10,491,752	137,803	10,825,523

Vessels employed in the Foreign Trade of the United Kingdom.

Countries to which the Vessels belonged.	Inwards.—1838.		Outwards.—1838.	
	Ships.	Tonnage.	Ships.	Tonnage.
United Kingdom and its Dependencies	12,890	2,464,020	11,471	2,058,240
Russia	249	67,346	124	34,501
Sweden	156	19,861	128	15,891
Norway	867	132,706	243	24,535
Denmark	897	63,920	855	61,545
Prussia	883	169,817	432	76,322
Other German States	913	67,180	637	47,021
Holland	589	50,358	444	42,963
Belgium......	279	35,335	361	51,278
France	983	49,776	1,600	125,565
Spain	49	5,503	55	6,300
Portugal......	46	4,338	23	2,277
Italian States	32	7,261	29	6,301
United States of America	803	362,959	799	362,954
Other States in America, Africa, or Asia..	2	386	3	609
Total......	19,639	3,501,254	17,204	2,916,302

Russia, with its universal climate, and its indefinite power of producing at home every raw material, bids fair, under a manufacturing policy, to supply the old continent with all desirable fabrics; while the United States, from the same causes, will in regular course supply the new continent. We have a ready-formed market, but it cannot continue to carry the war debts!

The greatest fair in Europe, is that at Niznei Novogorod, adapted to Asia and Europe, and attended by above half a million of all nations. The goods sold, value nearly 3 millions.

In 1836, the importations at Petersburgh were 181 millions of roubles, and the exports 121 millions, in 1105 ships.

Merchants, called Shikarpoorees, carry on the internal trade of Asia, from Calcutta to Astrakan, through Cabool, Bokhara, Meshid, &c., and negociate bills on those places.

The Nubians, &c. will buy no watch which has not George Prior on it!

Yemen has springs and rivulets, lost in the sand. Frankincense and gums, spices and coffee, luscious dates, and honey of the rock.

In the flooded deltas of South America, the Indians live on mats suspended in palm-trees, and subsist on their sago, &c. 450 sago palms on an acre yield 60 tons of sago.

Taking the commerce by *navigation* to be 100 for the United Kingdom, the United States will be 70; France 60; Russia 35; Holland 45; Denmark 20; Portugal 20; Spain 22; Germany 15; Prussia 25; Sweden 18; Italy 15; Austria 12; Turkey 10. But, taking the intercourse by *proximity of frontiers*, then France 45; Germany, &c. 50; Switzerland 25; Italy 12; Russia 48; China 55; Turkey 30; Egypt 25; Arabia 20; Brazil 12; Mexico 15; U. States 10

EGYPT.—The Pacha's son, *Ibrahim*, is the active improver and the genius of Egypt. He builds and rebuilds extensively, and is the soul of most domestic improvements. Under his patronage, Alexandria is becoming an extended and ornamented city, while he is also the popular and successful general of his father's armies. *Bogas* has for many years been the Pacha's very able minister.

The Pacha, like his predecessors, receives all the superfluous produce for his public revenue. He is, therefore, the general land proprietor and merchant, paying for all from his treasury, in money or kind.

This resource he has greatly increased by introducing the culture of cotton extensively, and also rice and sugar. His exports of cotton are now not less than 100,000 bales of about 200 lbs. each, and of sorts that fetch double the mean price of American. Liverpool takes one half, and France and Austria the remainder.

There are some cotton mills for spinning and weaving, on the English principle, and 2 or 300 small native establishments for local purposes; but they do not rise in spinning above No. 30 or 40.

It is the favorite policy of the Pacha to educate Egyptians in Europe, and to employ them as heads of departments, in preference to foreigners; but, he has many English, French, Italians, &c. in various services, with Egyptian names and ranks.

There are about 30 mercantile houses at Alexandria, about half of whom are English. The Pacha deals with them, and they deal with him for Egyptian products.

As he has few or no minerals, he deals with the English for iron, coals, &c. &c.

The cotton, after preparation for shipment, is sold by the Pacha's agents to the importing and exporting houses, chiefly at Alexandria, at such prices as distant markets and the supply warrant.

The Pacha never patronizes any improvement till he has witnessed its operation. He thought ill of the bulk and weight of a locomotive engine, and to try it laid down a temporary railway. He then witnessed, with astonishment, its rate of 45 miles an

tour, produced by Mr. Galloway, the merchant, who had imported it.

The Pacha has, by formal edicts, put an end to that horrible traffic in the persons of the black races, which for thousands of years have disgraced the countries south-west of Egypt. There are to be no more droves of black families from Central Africa, brought into Egypt.

Turkey, or domestic slavery, is however unlike the field-slavery of the West Indies and America; for, all that is implied by Mahommedan slavery, are the duties of a domestic servant, attended by the best fare and care of the family.

The Turks, an idle and listless people, use Armenian secretaries for all correspondence; and, in Egypt, coptic secretaries. Even Mahommed Ali taught himself to read at 42, after arriving at the highest rank.

The pressure on the revenues of Egypt, (about 6 millions sterling) to sustain armies and fleets, obstructs the various improvements projected and desired by the Pacha. He can afford little but such works as promise profitable returns. Hence, the desirable railway from Cairo to Suez, 86 miles, is postponed, and that from Alexandria to Cairo, 120 miles, were only projects in 1839.

The canal from Alexandria to the Nile, and some short lines for communication and irrigation, have been the chief improvements. There are, however, founderies for cannon, musquetry, and small arms. Also, a printing establishment for works in Arabic, a gazette for ordinances and government edicts, and an arsenal well stored, with docks, &c., in Alexandria.

The army musters 120,000 men, well equipped, and the navy is about 30 ships, some of them of the largest size.

Cairo is the emporium of a great African and Asiatic commerce, and, before the discovery of the Cape, was the focus of the East and West. It is about 90 miles from Alexandria, 69 from Suez, 220 from Jerusalem, 12 from the Pyramids, and 20 miles above the Delta; the Nile being crowded with vessels between Boulac, its port, and Rosetta and Damietta on the ocean.

The Cape of Good Hope, a geographical and commercial centre of the East and West. The land-holders are *Wyn-boor* (wine-grower), the *Koorn-boor* (the corn-grower), and the *Vee-boor*, the grazier. The wine has what the Dutch call the *cape-smaak*, said to arise from the stalks of the bunch being pressed with the grapes. The wheat is excellent, and it is sold in *Muids*, of 3·1 bushels. The graziers have immense tracts in the interior, with ill-contrived dirty houses. The new settlements near Algoa Bay, &c. are miserable traps for emigrants.

All trade in Central Asia and Africa is carried on by caravans; a word which means a body of merchants with their goods on camels, generally consisting of several hundred richly laden. The deserts through which they travel are composed of the finest white sand, as mobile before wind as water itself, and moved in waves resembling water. The analogy is rendered more exact by the occurrence of *Oases*, or little islands scattered up and down the deserts, where water is found, often of great fertility, and houses of accommodation, called *caravanseras*. Here they rest for a week or fortnight, and then proceed over the sandy desert, till after some days they arrive at another *Oasis*. Their pace in travelling is from three to four miles an hour, and their routes are so extensive, that they are frequently six months on the journey

The *Banda Islands*, so famous for their growth of nutmegs and mace, are ten in number. The Dutch East India Company engross the spice trade, and permit the cultivation of the nutmeg only in four of the islands. About 190,000 lbs. are exported and sold in Europe, and 50,000 lbs. in India.

Caravans go annually to Mecca from four places; one from Damascus; two from Cairo; three from Zibeth, near Babelmandel; and four from Bagdat. Every caravan has four officers. Djidda is the emporium of Arabian trade. It owns 250 vessels, and imports and exports to a large extent, supplying all the countries round with Indian and other produce. The ceremonies of the pilgrimage at Mecca are followed by a great fair of merchandise, brought by wealthy pilgrims.

Ceylon, 280 miles long, and 160 broad, produces cinnamon and other spices, with all other products of the East; and is so fertile, that the natives call it the seat of Paradise. The island also yields a profusion of precious stones, with lead, tin, and quicksilver. Ceylonese elephants are celebrated; and there is a pearl-fishery, with oysters nine inches round. The season is in February, and employs 150 boats, each with 10 divers, who hold their nostrils with their left hand, and remain about two minutes under water, and some double that time.

The trees which cover Ceylon are the jack, the bread-fruit, the jamboo, the cashew, the areca, and the invaluable cocoa-nut. The underwood is the black pepper, betel, coffee, cinnamon, tobacco, cotton, &c.

Chinese abound in all the oriental islands, and are most ingenious and industrious. Their grotesque and finely-painted junks are also in every trading port, laden with sugar, coffee, silk, tea, tin, spices, camphor, &c. in exchange for cloth and fabrics.

Armenia is inhabited by a million of Christians, who are the merchants of Asia and Turkey, and also the chief manufacturers.

The Persees, ancient fire-worshippers expelled from Persia, are the factors, capitalists, and leading merchants of Bombay, where there are 8000.

The Banians are the mercantile *caste* of the original Hindoos. The other three castes are the priests, the soldiers, and the working artizans. They call themselves *Shudderies*, which signifies innocent and harmless. They never kill any thing, nor eat of any thing that has been alive, while they relieve and assist every animal in distress or difficulty. They are the wealthy

merchants, bankers, and brokers of India; and they are as remarkable for their integrity as for their kindness and humanity.

The *Japanese*, warned by the fate of India, in permitting the encroachments of Europeans, sturdily resist every overture of the Russian and other governments to trade or hold the slightest intercourse. They permit the Dutch to send two or three ships to Nangasaki, under restrictions and privations of the most humiliating character. They trade with the Chinese and these with them, but they shut out all who unite the plausible objects of trade with thirst for domination. They permit but ten Chinese junks to enter their ports in a year, making two voyages.

The Dutch intercourse with Japan is by a factory at Decima, with a guarded visit of some deputies every four years to Jeddo. It appears that the independence of Japan has been assured by rocks, shoals, and currents, which render access fatal; but, in the finest climate, it is cultivated to the tops of the hills like a garden, and that 34 millions of inhabitants have carried horticulture and agriculture to unparalleled perfection.

The periodical increases of the imports of COTTON, for many years, have been subjects of exultation to British statesmen, but 1839 presented an extraordinary exception! In the first five months of 1838, the imports from the United States were 230,668,203 pounds; but, in the first five months of 1839, they were only 117,351,134, or nearly as 2 to 1. The falling off at Liverpool was from 220,222,413 in 1838, to 110,311,372 in 1839. The effect was the reduction of time, in factories, from 69 hours to 30 or 40 per week.

In 1834, Jamaica transmitted to the United Kingdom 1½ million lbs. of *Sugar*,—Demerara ⅓, Trinidad ⅙, and the Mauritius above ⅙. The imports were 4,743,114 cwts.

In England, every inhabitant consumes 7 lbs. of sugar. In France, 5 lbs. In the United States, 12 lbs. per annum.

In 1668, the East India Company ordered their Agents "to send home by ther ships 100 lbs. waight of the best tey you can gett." In 1838, the imports were 48 millions lbs.!

Tea was recognized with coffee, in a tax of 8*d*. per lb. in 1660; but the first importation of the East India Company was a single 100 lbs. in 1667. Tea, in China, is bought at so many *talo* (6*s*.) per *pecul*, (133⅓ lbs.) The sorts of teas used in the United Kingdom are in the ratio of 20 million lbs. of congou, 4 twankay, 4 bohea, 1 hyson, and 1 of four or five other sorts.

For many years it was the custom to smuggle *Opium* from India, in payment for Teas. But the Chinese government imprisoned all these opium smugglers in 1839, and punished with death the native confederates.

The consumption of tea in 1838, in different countries, was as under, in millions of lbs.:—

Great Britain	36	to 36
Ireland	4½	6
United States	8	10
Russia	6	8
Holland	3	3
Germany	2	3
France, &c.		1

10,000 tons of coffee are consumed in Great Britain, 40,000 tons in France, and 10,000 in the Netherlands and in Spain and Portugal. The annual consumption is about 127,000 tons, or 267 millions of lbs., of which our West Indies produce a 13th, and Brazil a 4th.

The consumption in 1834, of various Spirits, was as under:—

Brandy (Gallons)	1,388,639
Rum (do.)	3,454,707
Geneva (do.)	21,632
Other Sorts (do.)	2140
Distilled, proof	23,216,272
Gallons............	28,083,390

The malt and unmalted English was 4,652,838 gallons; the Scotch from malt, &c. was 3,193,091; and the Irish was 307,448. Ireland and Scotland export to England, and Scotland to Ireland; altogether, 3½ millions of gallons. There were, in the United Kingdom, 82,600 spirit licences, and 760 houses are assessed as Gin Palaces.

The duties on rum are 9*s*., on brandy and Hollands 1*l*. 2*s*. 6*d*., while, on these pernicious British spirits, it is only 4*s*. 11*d*.

The excuse is illicit distillery, for perhaps a 5th more is even now made than paid for. The quantities made in England are about 8½ millions, in Scotland 6½, and in Ireland 9½, and in Guernsey 53,000 gallons. 1-3d is distilled from malt only, 2-3ds from malt and oats, or wheat; 10,263 gallons from potatoes.

In 1836, there were 6,240,342 gallons of wine entered for home consumption, of which 1-12th was Cape, at 2*s*. 9*d*. duty. 1-25th French, at 5*s*.; 1-50th Madeira, and 5 millions Portuguese and Spanish. The rest were Rhenish 49,000, Canary and Fayal 53,000 gallons.

The United Kingdom consumes 45 millions of quarters of various grain, and about 6 are reserved for seed, making in all 51 millions of quarters. The supposed proportions of consumption are, for man, 14·5 wheat, 1·5 barley, 9 oats, and 2 rye, beans and peas 27; and for animals 13; and manufactories of beer and spirits, 5.

The evidence given to the agricultural commission fixes the annual consumption of wheat, in Great Britain, at about 12 million quarters. The home-produce is 10,800,000 quarters—the Irish is 600,000, and the foreign equal to the Irish.

In 1831, the estimated consumption of wheat in Great Britain was 15·64 million quarters, including 1·3 for seed.

A sack of flour is 4-5ths the value of 8 bushels of wheat; and the quartern-loaf is 1-100th of the price of the 8 bushels.

Two pounds of wheat make about 3 lbs. of bread.

In the annual consumption, of the United Kingdom, of 50 millions of quarters, or 400 millions of bushels, per annum, a rise or fall of 1*s*. per bushel in the year is 10 millions sterling, or per week is nearly 200,000*l*. At 2*s*. 6*d*. per bushel, per annum, the difference is 25 millions.

Prices of Wheat per Quarter, as exhibited in the Audit Books of Eton College every 25th year, from the year 1646 to 1825.

Years.	Prices per Quarter, Winchester Measure. Price at Lady-Day.		Price at Michaelmas.		Mean Price for the Year.	
	s.	*d.*	*s.*	*d.*	*s.*	*d.*
1646	37	11	60	5¼	49	2
1671	35	6¾	39	1½	37	4
1696	64	0	48	0	56	0
1721	35	6¾	31	1½	33	4
1746	37	4	32	0	34	8
1771	49	9½	51	6¾	50	8
1796	96	0	64	6	80	3
1825	84	0	84	0	84	0

1836 - Feb. - 39*s.* 3*d.* Sept. - 46*s.* 6*d.*
1837 - - - 54*s.* 8*d.* - - 54*s.* 11*d.*
1839 - - - 73*s.* 7½*d.*

A bale of New Orleans cotton occupies 20 cubic feet, and weighs 400 lbs.

Forests extend over a third of Germany, Sweden, Norway, Russia, and Bohemia. They are a fourth of Prussia and Austria. A fifth of Belgium, a sixth of Switzerland, an eighth of France, a ninth of Italy, a twelfth of Spain, and only a fortieth of Great Britain.

The bones imported for manure, in 1836, were value 171,806*l.*

The Manilla Galleon used to bring to Acapulca about 350,000*l.* of eastern merchandize, in return for about 250,000*l.* of the precious metals.

The Commissariat, in 1814, drew for 26½ millions, and, in 1815, for 20½ millions for expenditure abroad, and thus enabled foreign nations to import and pay for 35 and 40 millions of British goods more than our imports.

Birmingham and Sheffield complain that the foreign inclination to import unwrought iron and steel, so as to manufacture for themselves, has proved very injurious to the industry of those towns.—*Scholefield.*

The agricultural produce exported from Ireland is about 7,000,000 tons. The import trade is 385,000 tons.

The aggregate imports to Bristol and other ports could not be less. Their value stands in place of remittances, in cash, to absentee landlords in England, and on the Continent. Ireland, also, sends to England 3 million quarters of grain, chiefly oats, besides linen, flax, feathers, &c.

Liverpool alone imported from Ireland, in 1837, to the value, in live stock, of 3½ millions, which included 250,000 sheep and lambs, 85,000 cattle and calves, and 595,422 pigs.

Marshall maintains that the bills bought up on England by certain governments, to pay the interest on British loans to them, operates as a deduction for the like amount on the price of our manufactures; so that the interest of those loans is, in fact, paid by the manufacturing labour of England. Bills drawn in England for exports are, he proves, depreciated to the full value of those remittances for interest.

By the Assiento treaty, England had the privilege of importing 4800 negro slaves into the Spanish Colonies. It had previously been enjoyed by France, but was conceded at the Peace of Utrecht.

Fowell Buxton and others assert, that Portuguese, American, and other contraband traders carry on, in 1839, as active and cruel a slave-trade as ever existed! The motive is the enormous profit and the ready South American markets. He proposes extensive African colonization and civilization, as the only cure for so frightful an evil.

Socotra is an elevated primitive rock. Its chief produce about two tons of spontaneous *aloe spicata* and the gum *sanguis draconis*. It is about 1000 square miles, with 3 or 4000 inhabitants.

Chancellor, an English captain, in 1553 first sailed into the White Sea, and this led to the building of Archangel, and the commerce of Russia.

The whale-fishery is on the decline, and without profits. Gas and vegetable oil have superseded this disgusting product. Our own vegetable oil equals, in brightness and whiteness, the Colza of France and Flanders, and is much cheaper than any whale oil.

MANUFACTURES.

All mankind are manufacturers who are not savages. We find no circle of wants supplied without some labour and ingenuity. Our forces were tools and manipulations, presented by the mechanic powers. We then adopted wind and water, and, in fine, the force of steam; and then, by the contrivances and interchanges of Androides, astonish even ourselves by the results. We have, also, recourse to chemical re-agents; and, by ferments and combinations, produce other articles. These, in both relations, we call manufactures, making for ourselves and others, and then using our fabrics and compounds for interchange. Social industry and individual profit are, therefore, compounded of the manual labour of agriculture, and the manual arts of manufacture. This article applies chiefly to the latter.

It is a rule with the Chinese, which has tended to perpetuate their empire, that nothing shall be made by the direction of natural powers which can be made by hand. Hence, family employments are constant from age to age; but, with us, every kind of competition is encouraged, and no man can anticipate for his children. Society, in consequence, is a ruinous scramble.

Previous to Hargreave's invention of the Spinners' Jenny, and Watt's improvements on the steam-engine, the manipulations were distributed into small workshops, or in family-circles; but, when mechanical power and combination were introduced, the manufacturers were concentrated in towns and factories, which assembled and

employed the heretofore-scattered work-people. It was only a change of location, and not an increase, as has been absurdly pretended. It was, on the contrary, an immediate decrease of hands by the power of the machinery used.

Modern manufactory produces cheaper fabrics, by the subdivision of individual labours into many operations; and, by the free use of great powers of wind, steam, and water, which is little expense, never tires, and is capable of being directed to any operation, however incommensurate with animal powers.

If great human misery is a consequence of this congregation of labourers, the fault lies in the avarice of employers, in the too great number of hours of work, and in payment below the price of wholesome and abundant subsistence,—points to be assured by effective laws.

The spinning and weaving of the fibrous materials, and the manipulations of metallic ores, constitute what is meant by our MANUFACTURING SYSTEM. We make many other articles, such as glass, earthenware, machinery, &c. &c., but they do not embrace masses of the population. Bread, cheese, beer, spirits, &c. we may manufacture, but they are not peculiar features for export. In fact, what is called our manufacturing system had its origin between 1785 and 1790, when some success in the invention of *secret* machinery led to statesmen's dreams, that we might "*manufacture for all the world*," and, by the sale of our fabrics, command the wealth and natural productions of all nations.

Competition among employers, and now competition between nations in foreign markets, have been the causes of the state of suffering which Trollope so well describes; but conventions in favour of negroes ought to be imitated, in this case, of white and infant slavery. For 10 hours' labour, per day, all nations would gladly pay the price of a 4-lb. wheaten loaf to children under 12; to boys and girls under 20, the price of 2 loaves; to women, the price of 2½; and, to men, the price of 3½. Till something of this kind is immutably fixed, the modern manufacturing system will continue the greatest curse that ever befel the human race!

From 3*d.* to 5*d.* per day is now the price to children; from 8*d.* to 10*d.* per day, the price to boys and girls; from 1*s.* to 1*s.* 6*d.* the price to women; and, to men, except the aged, from 2*s.* to 2*s.* 6*d.* Men, who conduct and pay smaller departments, gain according to their exactions on those beneath them; and, hence, we hear of 5*s.* or 7*s.* 6*d.* per day.

No manufacture ought to be tolerated which does not pay the operatives the wages of subsistence; and, which affords no profits to merchant manufacturers beyond the exactions and cribbings from the dependent operatives.

In all factories, the hands under 18 are, by a late law, not allowed to work more than 12 hours per day, or 69 per week; they are not to work in the night between ½ past 8 and ½ past 5. An hour and a half out of the 12 is allowed for meals.

This monopoly began, in Great Britain, about 1785; and was sustained by the application of secret machinery, for half a century; but, the machinery being no longer exclusive in 1840, and the raw material open to all, manufactures may be expected to be equally diffused; and, the supply of foreign markets depend merely on price, quality, and taste. This, of course, is a mere question of time; but, it is not to be dissembled that foreign governments are desirous of employment for their people, that the materials wrought are often native, and that labour is cheaper.

The home-trade is to the Foreign trade, in Great Britain, as 9 to 1. In France, as 11 to 1. In the United States, 12 to 1. The disparity proves the wisdom of the Chinese and Japanese.

Free-trade at home is desirable, and the state is served, whether one district gain or lose; but free-trade with foreigners, unless their trade is as free with us, is the system of an unequal balance, and pregnant with mischief and ruin.—*Malthus.*

The ancient staples of England were wool, leather, skins, lead, and tin; and they used to be conveyed to staples or marts, held at Newcastle, York, Lincoln, Norwich, Westminster, Canterbury, Chichester, Winchester, Exeter, and Bristol, where public sales, under the mayors, were held. Butter cheese, and cloth, were afterwards added The staple of the wine and corn of the north of France used to be the Greve.

No fair can be held in England without a grant from the crown. Stourbridge and Weyhill are now the chief fairs in England. St. Germains, Lyons, and Rheims, are famous fairs in France; Frankfort, Leipsic, and Nuremburg, in Germany; Pesth, in Hungary; Zurich, in Switzerland; Novi, in Italy; and Nishi-Novogorod, in Russia.

The manufacturing districts of England are those in which beds of coal lie. Cheap fuel is essential to the steam-engine, and all metallic arts, while a temperature of 70° and 75° is necessary even to fine spinning processes.

Manufactories are also localized by the skill of the population in each particular line, and by the residence of machinists and co-operative branches; and, this is the reason why manufactories cannot remove, or be established in foreign countries, since various labour and skill is necessary to confer effect on the chief operation. It is also the reason why particular fabrics have peculiar excellencies, or faults, it being impossible to alter the habits of work-people in the most trifling detail. Hence, too, it is, that factories are often wrought even at a loss, for if the artizans are scattered, they cannot be brought together again.

In the mining and hardware districts, the Birmingham, in population, is to the Sheffield as 15 to 4; and the Newcastle coal, to the Cornish copper and tin, nearly 7 to 6.

In fibrous articles, the cotton population is to woollen as 3 to 2: to hosiery and lace, as 4 to 1; to the silk, as 11 to 1; and to the worsted stuffs, as 11 to 1. Cotton is about four-ninths of our manufactures.

Every manufacture has a first epoch of 50 per cent. profit; then a home competition, which reduces it to 10 per cent., and a foreign competition, which reduces it from 5 per cent. to 0; and, it finally adjusts itself, if it be a necessary, at from 5 to 10 per cent.

Trade in Germany, &c. is carried on in crafts or castes, like the city companies in London, but under regulations.

In 1839, the persons employed in the factories were 414,635; and, those under 13 were 32,464. The gross number, per Lord Ashley, was 419,590, of whom 57½ per cent. were females. Between 13 and 18 there were 98,174, of whom 56,792 were females.

The foreign products imported for manufacture into the United Kingdom, in 1838, were—

FLAX and TOW....	1,024,734	cwts.
HEMP............	763,943	cwts.
HIDES	318,763	cwts.
SPELTER..........	77,662	cwts.
SILK, Raw........	368,722	lbs.
——, other sorts ..	133,700	lbs.
SKINS	3,200,000	skins.
COTTON WOOL ..	460,756,023	lbs.
SHEEPS' WOOL ..	567,346,025	lbs.

Besides barilla, bark, dyes, oil, saltpetre, tallow, tar, turpentine, &c. in aid.

The cost of these articles, set against the values of the products exported, is the value of this system of importing to manufacture.

The manufactures from our national products, and of all profit but the labour, are—

Hardware goods and cutlery.
Earthenwares and porcelain.
Paper and books.
Manufacturing machinery.
Coarse woollen goods.
Worsted goods and stuffs.
Malt liquors.
Cheese, Cheshire, &c.
Tin, copper, brass, and iron goods.
Watches and clocks.
Coals, salt, and chemical preparations.

These national staples are under 10 millions' worth.

Produce and Manufactures of the United Kingdom, exported according to the Declared Value, 1838.—Total £43,338,839.

Alum	£5,753
Apparel, Slops and Negro Clothing	584,934
Arms and Ammunition . .	333,697
Bacon and Hams . .	49,226
Beef and Pork, Salted . .	118,486
Beer and Ale . . .	311,792
Books, Printed . . .	143,945
Brass and Copper Manufactures	1,221,073
Bread and Biscuit . .	9,839
Butter and Cheese . .	230,674
Cabinet and Upholstery Wares	77,201
Coals and Culm . .	483,630
Cordage	92,966
Corn, Grain, Meal, and Flour .	34,519
Cotton Manufactures . .	16,709,136
Cotton Yarn . . .	7,431,869
Cows and Oxen . . .	4,344
Earthenware of all sorts .	651,086
Fish of all sorts . . .	298,001
Glass of all sorts . .	375,839
Haberdashery and Millinery .	514,053
Hardwares and Cutlery .	1,497,525
Hats, Beaver and Felt . .	91,256
—— of all other sorts . .	61,584
Hops	17,397
Horses	63,283
Iron and Steel . . .	2,530,886
Lard	22,433
Lead and Shot . . .	154,108
Leather	267,193
———— Sadlery and Harness .	90,841
Linen Manufactures . .	2,785,236
——— Yarn . . .	587,891
Machinery and Mill Work	627,146
Mathematical and Optical Instrum.	24,474
Mules	6,131
Musical Instruments . .	65,292
Oil, (Train) of Greenland Fishery	10,463
Painters' Colours . .	177,678
Plate, Plated Ware, Jewellery	240,393
Potatoes . . .	12,570
Salt	221,111
Salpetre, British Refined .	28,079
Seeds of all sorts . .	10,331
Silk Manufactures . .	777,273
Soap and Candles . .	334,248
Spirits . . .	17,385
Stationery of all sorts . .	218,176
Sugar, Refined . . .	553,222
Tin, Unwrought . .	101,800
—— and Pewter Wares .	458,796
Tobacco, Manufactured, and Snuff	12,446
Tongues	5,490
Umbrellas and Parasols .	50,702
Whalebone . . .	6,201
Wool, Sheeps'	381,356
——— other sorts . .	24,390
Woollen and Worsted Yarn .	384,535
———— Manufactures . .	5,793,417

When machine-spinning was first substituted for hand-spinning, the fabric being more uniform, the price was nearly the same, and 30s. or 40s. was obtained for numbers 25, 30, and 40. The profits were, therefore, 2000 per cent., and fortunes of millions were rapidly accumulated. In half a century, the 30s. and 40s. of 1790 fell to 2s. For, as soon as the thumb and finger, or double rollers, the daffer-crank, the perpetual sliver, &c. were understood, home competition lowered prices to 5, and even 2½ per cent.; and, in fine, cheap corn and low wages now threaten to transfer the whole to other nations.

Latterly, yarn has been chiefly in foreign demand, as being better and cheaper, prepared by our machinery, by which foreigners take the better profits of weaving, ing, dyeing, finishing, fashioning, &c.; and, 150 millions of lbs. of cotton, linen, and worsted, are exported in this first state. So, also, with pig and wrought iron, instead of finished hardware goods. Profits are thus reduced to a trifle, and depend on low wages and economy of manual labour.

The consequences of the falling-off and

decay of such a system of buildings, machinery, towns of operatives, &c. on which millions have been expended, will be the most disastrous that ever befel any nation. At the same time, the case does not seem to admit of any palliative. Secresy, which was impossible, was the only security for permanence.

There are now in this country not less than 16,000 steam-engines at work, some of 1000 horse-power. Taking it that, on an average, these engines are each of 25 horse-power, this would be equal to 375,000 horses. Five men and a half are equal to the power of a horse; we have thus, therefore, a power, through the medium of steam-engines, equal to near two millions of men. Each horse for his keep, per year, requires the produce of two acres of land, and thus 750,000 acre, are at liberty for human subsistence.

The English male population is 7¾ millions, and 4½ perform as much labour as 30 millions would perform; for steam-engines, wind and water-mills, &c. are estimated at thrice that of men; hence, as much labour is performed in the United Kingdom as could be performed by 30 millions of men; for animals and machinery add 3 times what man could perform alone.

The career of England, in the experiment of manufacturing foreign products, commenced about 1790, and proceeded as a general monopoly, by machinery, till 1837. The construction of machinery abroad, with the aid of emigrant artizans, has now enabled foreign nations and growers of the raw materials to enter into competition; and, aided by their cheap labour and cheap food, our manufacturers can now be undersold, even in England, after payment of our protecting duties. In 1840, a 7 or 10 years' struggle is pending.

The improved operations in fibrous materials began to create attention about 1786, and they became an object of political attention about 1790.

The manufactures and manipulations are worth, in labour and profits, another 10 millions, thereby rendering minerals and hardware, in all forms, the most important branch of our manufactures, though other nations are now fully alive to the value of this branch of industry.

The whole of the IRON made in Great Britain, in 1740, was 17,000 tons, from 59 furnaces. In 1788, it was 68,000, from 85 furnaces; and, in 1827, it was 690,000, from 284. In 1839, the produce was nearly a million of tons, in 360 working furnaces.

About 360 furnaces make nearly 800,000 tons of pig-iron, or 2200 tons each per ann., *i. e.* 5½ per day, or 40 per week. A furnace in mining, smelting, forging, tilting, &c. employs 280 men, women, and boys, who, at 16*s.* per week, cost 224*l.*, besides the mine, coals, lime, machinery, &c., a full 100*l.* more, *i. e.* about 7*l.* 12*s.* per ton. Then, as 2000 tons per week are produced by 280 hands, 800,000 tons of pig-iron would employ 90 or 100,000 hands.

Above 70,000 hands are employed in the mineral works in Cornwall. Huel Alfred has yielded 130,000*l.* profit. At Gwennap, a shaft is 1600 feet deep. Extracting water employs the power of 45,000 horses.

Exports of British Produce or Manufactures from the United Kingdom, in 1838, compared with preceding year 1837.

	1837.	1838.
	£	£
Coals and Culm .	431,545	484,305
Cott. Manufactures	13 640.181	16,700.468
—— Yarn . . .	6,955,942	7 430.582
Earthenware . .	563.237	670,985
Glass	477.767	376.524
Hardw. and Cutlery	1,460,808	1,507,478
Linen Manufactures	2,133.744	2,919.719
—— Yarn . .	479,307	655,699
Metals, viz.—		
Iron and Steel .	2,009,259	2,530,903
Copper and Brass	1,166,277	1,226,258
Lead	155.251	156,150
Tin, in Bars, &c.	74.737	103.230
Tin Plates . .	350,668	434,749
Salt	193.621	223,372
Silk Manufactures	503.673	778,031
Sugar, Refined .	453,9[illegible]4	550,506
Wool, Sheep's or Lambs . . .	185,350	432,067
Woollen Manufac.	4,660,019	5,792,156
—— Yarn .	333,098	365,657
Total of the Brit. Exports .	36,228,468	43,338,839

Thus it appears, that of the Exports of *foreign* raw materials in 1837 8.

Cotton Goods . .	£24,131,000
Hemp and Linen . .	3,575,000
Silk	778,030
Saxony wool, about	5,000,000
Not quite .	£33,484,030

Leaving less than 10 millions of native products exported.

IRON AND HARDWARE.

The Mineral Produce of Great Britain, on an average, of late years, and prices in 1838.

Silver..	10,000 lbs.....	£30,000
Copper	13,000 tons ..	1,300,000
Tin ..	5,500	558,000
Lead ..	46,000	950,000
Iron ..	900.000	7,000,000
Coal	25,000,000	10,000,000
Salt, alum, and minor produce		1,000,000
	Total value..	£20,000,000

The Ovoca copper-mines produce about 12,000 tons per annum; and, those of Bonmahon and Berehaven as much more.

Cornwall, in 1837, yielded 140,753 tons of ore, of which the copper was 10,823.

Crawshay's Iron-works at Merthyr Tydvil employed, in 1832, 5000 persons, 8 steam-engines of 50-horse power, day and night,

(equal 1200 horses); eight water-wheels, of 27-horse power; and 50 furnaces, 50 feet high.

An average of 27 cwt. of pig-iron makes a ton of wrought-iron; while others estimate the average at 30 cwt. to the ton.

The proportions in a furnace for a ton of bar-iron are—3½ tons of ore, 2¼ to 3¼ of coals, and ⅜ of lime-stone. And 3¼ tons of coals are used for the engine. Iron-stone is worth from 1*s.* to 2*s.* per ton, and coals about 3*s.* or 4*s.* Lime-stone is 2*s.* per ton; 7-8ths of all that is made is used at home. Coke is generally used, but coal is preferred for some iron.

The greatest product at one work has been 32,611 tons, from 12 furnaces at Dowlais, by Guest and Co. This is 2717 per ann. per furnace, or 7½ per day!—*Marshall.*

The blast furnaces of Great Britain are worked by coke of coal, but those of America, Sweden, &c. by wood or charcoal.

The Carron Iron-works, on the brook Carron, about two miles from Falkirk, have 7 smelting-furnaces, 20 air-furnaces, &c., with water-wheels for boring, &c., and 2 forges for malleable iron.

Scotland has 59 furnaces and 12 building. They work with hot air, and produced, in 1839, 184,080 tons; and, it is expected the new furnaces will, in 1840, raise the annual make to 280,000 tons. The largest make is at Gartsharrie, 29,316 tons, with 8 furnaces. Dundyvan and Calder make 25,000 each.

The annual returns for hardware goods, has been 17 millions, affording employment to 300,000 hands, old and young, male and female. The high-wrought articles have fallen, in ten years, from 68 to 31, down to 47 to 52.

Birmingham, called the toy-shop of Europe, and, as appears by the display in the show-rooms of Sir Edward Thomason and others in that town, justifies the name. It is the oldest seat of manufactory in Europe. It employs about 12,000 men, 15,000 boys, and 20,000 women and girls, within a radius of three miles. In making implements of war, agriculture, building, horse furniture, domestic furniture, locks, bolts, &c., jewellery, plated goods, fancy articles, trinkets, buttons, nails, &c. Its metals are steel, iron, copper, and brass. Silver is also used to the extent of 12,000 lbs. weight per ann., and gilding is carried to such high perfection, that a few pence worth of gold is made to cover a gross of buttons. Steel pens, latterly, consume many tons per ann., though a ton makes 10,000 gross of them.

Sheffield is equally distinguished in all cutlery, knives, scissors, razors, steel and plated goods; but, its manipulations are on a smaller scale than those of Birmingham. Rogers is the Thomason of Sheffield. Native coals, iron, and vast iron manufactories coucur.

Sheffield is famed for its knives, scissors, razors, and cutlery, though Rogers's show-rooms display an immense variety of local products, at once cheap and elegant. It employs, in manipulations, above 13,000, besides another 5,000 indirectly; and, is famous for its files, saws, grates, fenders, &c.

Owing to the reduction of the currency, in 1826, the prices of Birmingham goods fell from 40 to 80 per cent. The profitless prices have, however, doubled the value of the exports in 20 years, and raised the quantity from 10 000 to 17,000 tons.

A needle-making machine has been invented at Sheffield, 100 of which would occupy 4 rooms, each about 25 yards by 10, which will, by the power of a 6-horse steam-engine, be sufficient to produce 14,000,000 needles per week.

Eighteen different hands were employed, a few years ago, in making a Pin; not one of whom, if left to himself, could make 20 pins a day; by this division of labour, and the tools employed, they can make 5000 each per day. At present, an engine makes 64 every minute. The effect of labour-saving machines is still greater. The machine for making wool cards, that for making cut nails, and the machine for making screws, are American inventions, whose operation is to increase the product of labour one thousand fold. A piece of iron-wire, put into the machine, in a few seconds comes out a screw, perfect in all its parts. A blacksmith could hardly make fifty in a day.

Heated air renders anthracite coal a valuable means of smelting iron. It adds 40 per cent., and improves and carbonizes the iron.

The spring of a watch weighs ·015 of a grain, and a pound of iron makes 50,000. The pound of steel costs 2*d.* and a single spring 2*d.*, so that the 50,000 produce 416*l.*

At Molsheim, near Strasburg, are large iron-works, where machinery, saws, files, and edge-tools, are made in great perfection. In the United States, Pittsburgh rivals Birmingham.

Fahlun employs about 500 miners, &c. who work in an immense open excavation. It is under the government department of mines, consisting of some scores of presidents, secretaries, and professors, who regulate every thing connected with minerals, with despotic sway, and a sort of alchymical mystery! Fahlun yields 392 tons of copper, and other mines 419; and all Sweden 59,000 tons of iron.

COTTON.—1000 million lbs. of cotton are raised in different countries. About 500 in the United States; 185 in India; 110 in China; 30 in Egypt; and 35 in Brazil.

In 1786, cotton yarn, No. 100, sold 38*s.*: latterly at 2*s.* 3*d.*; and the mean price of the exported is 16½*d.*

Every bag of cotton averages 320 lbs., at 9*d.*, or 12*l.* 1 5th is wasted, and the 256 lbs. cost 7*d.* for spinning, wear and tear, &c. or 7*l.* 9*s.*, which, added to 12*l.*, is 19*l.* 9*s.*, or 1*s.* 6½*d.* per lb. 1-4th is exported as yarn, leaving 192 lbs., or, in value, 14*l.* 12*s.* for weaving, the mean cost of which is 3-4ths, or 11*l.* Hence, a bag in wove articles costs 25*l.* 12*s.*, and, in its ¼ yarn, 4*l.* 17*s.*, in wool, labour, and wear, and wear and tear, or

30*l.* 9*s.*; and a million of bags, about our importation, in round numbers costs 31 millions.

In 1720, Great Britain imported 2 millions lbs.: in 1751, 3: in 1780, 5; in 1787, 22; in 1800, 56: in 1810, 132; in 1820, 147½; in 1830, 260; and, in 1835, 360. France imported, in 1810, 25; in 1820, 44; in 1830, 90; and, in 1835, 91½. Since 1830, Switzerland has imported from 17 to 20 millions per annum. The United States, in 1835, imported 91 of India cotton.

In 1827, in cotton manufactures, 365,492,804 yards were exported, value 12,948,035*l.*; and, in 1836, 637,667,627 yards, for 17,183,167*l.* In 1827, at 8½*d.* per yard; and, in 1836, at 6½*d.* per yard.

In 1827, 44,878,774 lbs. of twist and yarn were exported for 3,545,578*l.*, at 1*s.* 6½*d.* per lb.; and, in 1836, 88,191,046 lbs. for 6,120,366*l.*, at 1*s.* 4½*d.* per lb.

In 1836, 2,546,177 lbs. of worsted yarn were exported for 358,690*l.*, at 2*s.* 10½*d.* per lb.

In 1836, 4,574,504 lbs. of linen yarn were exported for 318,772*l.*, at 16¾*d.* per lb.

In 1836, 192,352 tons of iron and steel were exported for 2,312,674*l.*

In 1836, 9 millions yards (besides pieces) of woollen manufactures were exported for 754,364*l.*, or 1*s.* 8*d.* per yard.

The Exports, in 1837, were 36½ millions, being 10 millions less than in 1836.

The cottons exported, in 1837, were 13,625,000*l.*, less than 1836 by nearly 5 millions.

In plain cottons we exported, in 1820, 113½ millions of yards for 5,451,024*l.*, nearly 1*s.* per yard; and, in 1834, 284 millions, 6,514,173*l.*, at 5½*d.* per yard.

In dyed or printed, in 1820, 134½ millions yards for 7½ millions sterling, at 1*s.* 1½*d.* per yard; and, in 1834, 271½ millions yards for 7,613,179*l.*, at 6½*d.* per yard.

In twist and yarn, in 1820, we exported 23 millions lbs. for 2,826,639, at 2*s.* 5½*d.* per lb.; and, in 1834, 76½ millions lbs. for 5,211,015*l.*, at 1*s.* 4½*d.* per lb.

The reduction of value is 51 and 46 per cent. nearly.

In 1835, the importation of cotton, at declared value, was 14,393,924*l.*, and the re-export was 1,514,933*l.*, leaving a balance of 1,314,291*l.* for manufacture.

Then the exports in a manufactured state, as goods, were 15½ millions, and, as yarn, 5½ nearly. Then deduct 12½ per cent. for freight, agency, &c. and the export of 20½ millions is 17½ millions for material and British labour; so that, paid for, the profit is about 4,100,000*l.* of national advantage, in labour, profit, &c. on cotton.

The 7 millions' worth of cotton yarns exported in 1837, would be about 80 millions lbs. weight, or sufficient to produce 400 millions of yards of average fabrics; being more than the same countries used to consume of our fabrics. In 1838, the evil increased in cotton, woollen, and linen.

The United States supply 6-7ths of our cotton-wool, and Brazil 1-10th.

1-15th of the cotton imported is used as wool, and 4-15ths is wasted in manufacture, so that only 2-3ds is wrought into yarn.

The profits on cotton-twist and yarn, at the average of 3*s.* 10*d.* per lb., was 2*s.* 1*d.* for labour and profit. But, in 1820, the 2*s.* 1*d.* fell to 1*s.* 4½*d.*; in 1830, to 9½*d.*; and, in 1838, to 8*d.*

Cotton employs 150,000 hands; the annual returns are 34 millions; capital 20 millions; 17 millions are paid in wages.

The hanks of cotton produced from 256 millions lbs. net, at 40, are 10,247 millions; which, at 840 yards per hank, is 4891 millions of miles per annum. At 350 to the lb., which is sometimes spun, a lb. is 168 miles long.

In regard to piece-goods, we have, for guide, an official statement of the American government, on the cost and value of 77 millions lbs. gross of cotton, converted into 230,461,900 yards of piece-goods. Our cotton left for manufacture is about 235 millions of lbs. gross, so that the quantities are nearly as 1 to 3.

It appears that the United States have 795 factories; we, 1070.

The gross wages of labour for the 2 quantities, 1 to 3, were 2,087,400*l.*, and ours, as above 8½ millions.

We employ, for spinning and weaving, 230,000 hands, averaging 10*s.* 5*d.* per week; they 66,459, averaging 12*s.*

Our males, besides weavers and children, are about 67,500; theirs, 18,479. Our females, 70,100; theirs, 38,827. Our children, under 28,574; theirs, 4961. Our weavers, hand and loom, 54,000; their hand and loom hands, 4760.

Their produce, 230½ millions, at 6*d.* per yard; our exports, 500 millions, at 6½*d.*

The average number of hanks, per lb., is from 40 to 45, and, of this, the usual produce per hand is half a lb. per hour; but, in high numbers, not above that quantity per two hours.

The loss of raw cotton, in spinning, is from an 8th to a 10th.

The average wages are about 9*s.* per week, from 30*s.* to 4*s.*; or about 3½ millions for spinning, nearly 2 millions for weaving, and ½ for clerks, &c.; in all, 6 millions.

The entire hands employed are,—

Proprietors	4,000
Clerks, &c.	3,000
Machinists, &c.	3,000
Spinners, &c.	143,000
Weavers and Dyers	75,000
In the Cotton Trade,	228,000

Hence the cost of labour, on 250 millions of lbs., is about 5¾*d.* per lb. of No. 40 or 45.

Power-looms require a piecer of broken threads to each loom, and statements in books about 1 to 2 looms, or 3 looms, to a piecer, are fallacious. A hand-weaver can produce but 48 yards in a week, but a power-loom can produce 120 yards in a week, or 2½ more, with a piecer at low wages; or, if 1 to 2 looms, at half the wages. Weavers used to get 2*s.* or 2*s.* 4*d.* per day;

and piecers, generally boys or females, get but 1*s.* 3*d.* or 1*s.* 6*d.*

In 1833, the power-looms in Great Britain were 100,000; and they were, in 1838, full 130,000. The hand-looms were above 200,000, but at steam prices!

Of the immense imports, 1,124,180 bags were North American, as Sea Island from 1*s.* 6*d.* to 2*s.* 6*d.*, or New Orleans from 7*d.* to 10½*d.* The Egyptian was 31,570, from 11½*d.* to 1*s.* 5*d.*; the rest from South America, Turkey, and both Indies. In 1837, the North American were but 846,268 bags.

The weekly averages, for home consumption, were, in 1838, 24,229 bags per week; and, in 1837, but 20,729.

The cotton manufactures exported, in 1837, were worth 18,482,586*l.*; in 1838, 13,632,146*l.*; and, in 1839, 16,709,736*l.* The yarn, each year, 6,120,326*l.*, 6,955,936*l.*, and 7,431,848*l.*

The whole is a wonderful circumstance in social history. 60 or 70 years ago, cotton fabrics were almost unknown, except as India chintzes and muslins; but cotton has now become that fibrous material which supersedes all others,—for at Manchester it is made to imitate all other fabrics. Nor has it reached its *ne plus ultra*, since, if every individual of the human race consumes about 20 yards, or 4 lbs., per annum, in various fabrics, the 700 millions would demand 2800 millions of lbs., instead of the 500 millions lbs. now manufactured in Europe. Cotton, therefore, cannot be overgrown, till the quantity is 5 times the present. The manufactory may change hands and undergo revolutions, but it will, nevertheless, be the universal staple.

Cotton manufactures have yielded a profit of 2 millions, not 4½; and the difference is reconcileable. But even this supposes that all the goods are paid for, *since the expences are absolute.* We export 15 millions of cotton piece-goods to 46 nations, so that, if 2 millions are not paid for, the trade is profitless. If but half, as commonly reported, then it is an annual loss of 5½ millions.

Of the raw material it takes, to produce 1 lb. of net yarn, according to the number of hanks in the lb.,—

	lb.	oz.		lb.	oz.
No. 20	1	2	No. 120	1	6½
40	1	3	140	1	8
60	1	3½	160	1	10
80	1	4½	180	1	13
100	1	5½	200	2	0

All above the lb. is wasted.

The numbers of cotton yarn used in cambrics, are No. 40 to 90 for twist, and 50 to 130 for weft; and, in jaconets, 60 to 100 for twist, and No. 80 to 100 for weft.

The prices of the spun cotton are from 15*d.* to 7*s.*

The numbers used in making the running white calicoes, are—

No. 1 (Lin.) St. calico, No. 20 T. 18 W.
2 (Printing) Sup. do. No. 28 — 28 —
3 (Do.) 74*s.* do. No. 36 — 36 —
4 Power-loom camb. No. 40 — 40 —

Of No. 1, about 4 yards make a lb.
2, from 8 to 6.
3, from 8 to 7.
4, about 6 yards make a lb.

There are about 5 yards in a pound weight of fine calico.

Calico was first manufactured in England in 1776; and 5*l.* 9*s.* 8*d.* was given for such pieces as now are sold at 7*s.* or 8*s.*

The muslin, commonly called book-muslin, was an Indian article, and by them called *bouk* muslin.

About one-fourth of the spun-yarn is now exported from Great Britain, to supply the looms of other countries.

The *bobbin-net*, or Lace manufactory of Nottingham and vicinity, has within 30 years superseded the cushion or loose lace fabrics of Buckinghamshire, Brussels, Mechlin, Cambray, &c. A patent was obtained by Heathcote for a lace-machine; and, on his patent expiring, the fabric soon created ruinous competition, and over-production.

Felkin states that it employs 200,000 persons, and consumes a million lbs. of cotton-thread No. 180 to 220, and 20,000 lbs. of thrown silk, producing 23 millions of square yards of bobbin-net lace, and returning nearly 2 millions per annum. Much of it is embroidered by hand at very low wages, at home and abroad. It is generally made two yards wide, by hand or power-looms, and reckoned by lengths of 240 holes called *racks*, and a square yard weighs 13 drachms. There are about 4500 machines, 1000 of which are worked by steam, and 3000 are within 20 miles of Nottingham.

In 1833, there were nearly 2000 bobbin-net machines in Flanders and France, producing 11 millions yards per annum.

Hindoo manufactures are generally imitated in Europe, and even retain their names. Calicoes, cossacs, jaconets, boucks, chintzes, mulls, japans, ballusores, bandannas, pullcates, ginghams, &c. &c. are all Indian names, and mere imitations. The Hindoos seem to be in manufactures like the Greeks in architecture, even in the minute circumstances of package, salvage, fringe, &c.

The Hindoos spin cotton, silk, and wool, finer than our highest numbers, (250 or 300,) with the simple distaff; and they weave muslins with the simplest looms, more perfect than our best machinery. An India muslin, or silk-handkerchief or shawl will still fetch, in the European markets, 4 or 5 often 20 times the price of European.

The capital, per acre, in growing cotton, is from 120*l.* to 160*l.*; and the average produce exceeds 200 lbs. The expence is from 6*d.* to 7*d.* per lb., which, with charges, is at least 8*d.*; and yet, for five or six years past, the lower kinds have been selling in the British ports from 5*d.* to 6*d.* per lb.

Cotton, as taken from the pod, is four times heavier than after the seed has been separated, and packing-presses reduce its bulk one-third.

Kennedy shews, that, since 1812, the price of labour, in cotton-spinning, has been lowered full 50 per cent.; Marshall says 70 per cent.

Women, generally, are most cruelly underpaid. They scarcely get, in all manufactories, the wages of a boy of 13 or 14. In farming-work, they get but 4d. or 6d. per day, and, as assistants in various trades, their best prices are 1s. per day; while, in skilful and tasteful occupations, they get but 1s. 8d. or 2s. per week. No slavery can be more unjust and heart-rending.

The United States and the continental nations, in 1836, manufactured 800,000 bales of cotton wool, chiefly in coarse yarns and heavy goods.

During the monopoly of the cotton patent twist, No. 100 sold for 38s., which, since, has sold at 3s. 6d. and under!

WOOL.—The quantity of Wool grown in England, in 1828, was 263,847 packs of long wool, and 120,657 short wool, total 384,502, at 240 lbs. each; but the staple being chiefly from 4 to 5 inches, and of a harsh and wiry texture, it is unfit for making fine cloths; it is therefore sold at a reduced price, and chiefly used for worsted, converted into stuffs, stockings, blankets, flannels, and carpets.

The wool of sheep deteriorates as the carcass of the animal is increased; hence, for some years, owing to the enlargement of English sheep by new breeds, the wool has become too long and coarse for fine cloths. Our long and coarse wool will not mill, or produce the required substance of clothing. For the last 20 years, therefore, superfine cloth has been made of wool imported from Hamburgh and Bremen, called *Saxony wool*.

The quantity of foreign Wool imported into the United Kingdom in the year 1833 was 38,076,413 lbs.; 25,370,106 lbs. were from Germany, and 3,516,000 lbs. from New South Wales. In 1838, the British wool and goods exported were valued at 6,683,698l.; and the woollen yarn at 384,535l.

Plush is made of a woof of woollen thread and a double warp, one of hair and one of worsted.

In Brussels carpets, the worsted yarn, raised to form the pile and shew the figure, is not cut. In Wilton, the pile is cut. The cloth is linen and worsted. The worsted yarn is put on small bobbins, often 1300 or 1800 in number. In Kidderminster, the warp and woof appear on the surface; but, in Brussels, the warp only. In Kilmarnock the woof predominates, and shews the figure. In French tapestry, the worsted warp of the web shews the figure. In Venetian, the pattern is the worsted warp of the web, and the woof is covered by it.

Broad cloth is from 60 to 63 inches wide, and there are from 40 to 60 yards in a piece; the lower sorts being longest. A middle-sized man takes 1¾ yards for a coat. A youth, 1½ yard. A stout or tall man, from 2 yards to 2½.

Soil varies the quality of wool; and chalk renders it more like hair than wool. Sheep's wool has been to Germany what cotton wool is to Georgia and Carolina, and iron and coals to England.

Within a century, woven goods were sent to Holland to be bleached, and were returned within six months.

The shawls of Cashmere are made between Hindoostan and Thibet, from the wool of the camel, while their sheep also produce fine white silky wool. The whole population is engaged in preparing the thread, and weaving these articles for commerce. They are generally three ells and a half long, and a half broad. The plain shawl, at the loom, is 8 rupees, and by finish raised to 100. They have often been sold in London from 100 to 300 guineas.

The exports of woollen manufactures, in 1837, were 7,636,117l.; in 1830, 4,654,207l.; and in 1839, 5,793,417l.; woollen and worsted yarn varied from 358,690l., 337,140l., to 384,535l. in the same years.

The woollen trade has not increased in exports since 1815. The gross value has fallen from 9 millions to 5 and 6 millions. Stuffs and woollen, with cotton alone, have increased nearly double. The United States and Canada take nearly half, chiefly inferior; and, the United States and Germany half the stuffs. Prussia, in 1834, took but 6 pieces of cloth, 1 of kerseymere, 36 of stuffs, 470 yards of flannel, and 911 of blanketting; Sweden, but 43 of cloth; Denmark but 39, and Greece but 13! All nations 521,214 pieces of cloth, and 1,298,775 pieces of stuffs. The declared value, in 1834, was 5¾ millions, of which the United States took 1¾; Germany above ½ a million, and the East Indies 7-8ths.

In 1796, nearly 3½ million lbs. of SHEEP's WOOL were imported, of which 3½ were from Spain. In 1810, it was nearly 10 millions; of which, 6 from Spain, and ¾ from Germany. In 1825, it was nearly 49 million lbs.; of which, 8 from Spain, nearly 29 from Germany. In 1831, 31 ¾rds, or 3½ from Spain, nearly 22½ from Germany. In 1838, no less than 56 million lbs.

Marshall states, that England contains 17¾ of sheep, which yield 384,592 packs, at 8 and 9 lbs. for long, and 4 or 5 lbs. per fleece for short wool. In Norfolk, he reckons 730,000, and in Kent 720,000.

The produce of the wool of British sheep, at 5½ each, is now about 570,000 packs of 240 lbs. or 137 millions lbs. About 3-4ths are short-wool'd breeds, whose fleeces are used in flannels, blankets, &c. The long wool, for combing, is a fourth at least, and used as worsted for stuffs and hosiery, of which, on an average of years, about 180,000 dozen pairs are exported. All fine and superfine cloths require a silky fibre and short staple, and are, necessarily, made of Saxony and Spanish wools. Their cost exceeds, by a million, the value of all the woollen exports, while it is the basis of vast rival manufactories in Prussia and Saxony.

Fleeces vary from 10 lbs. of long wool in Lincoln and 9 in others, to 2 and 3 lbs. in short wool. Spanish fleeces are 2½ to 3½ lbs.

The number of long-wooled sheep are 4½ millions, and of short-wooled breeds about 15 millions.

The total produce of British wool, in the

United Kingdom, is above 520,000 packs of 240 lbs., or half the weight of cotton.

In 1835, the sheep and lambs' wool washed at Leeds, was 20 million lbs., of yarns 1,305,235 lbs., and stuffs half a million pieces. At Halifax, it was 19 million lbs. of wool, 6000 lbs. of yarn, and 712 pieces.

Cloths, blankets, flannels, stuffs, carpets, and hosiery, consume about 160 million of lbs. of wool, of which 110 are British and 50 imported. The sales are in pieces of about 30 yards each.

The term Worsted is derived from a place in Norfolk, where it was first made, about 1300. Spanish wool was first used in England, in cloth-making, at the Revolution. The machinery in cotton manufactures was extended to woollens about 1788.

Silk and worsted combined are the fabrics called Norwich crapes, Bombazines, Poplins, Mousselin-de-Laine, &c.

SILK.—In 1827, there were imported 4,389,582 lbs. of *Silk*; and, in 1833, but 3,663,679. In 1837, the exports of silk manufactures were 916,777*l.*; in 1838, 503,653*l.*; and, in 1839, 777,273*l.*

England alone consumes 4 millions of lbs., and every lb. requires 3500 worms. China must have consumed 50 times this quantity for 3000 years, it being the universal clothing. It is produced mostly between the 30th and 40th degrees. The East India Company imported from China about 3000 tons, and the quality is always the same.

Raw silk wastes a fifth in throwing.

It requires 14,000 millions of silk-worms to produce the silk consumed in the United Kingdom annually.

Lyons has 22,000 silk-looms, and France manufactures nearly 3 millions of lbs. of silk. Italy produces 4 millions of lbs. Turkey produces 2 millions of lbs. Russia makes silks at Novogorod.

In 1828-9, France manufactured 220,000 bales of silk, or 50 or 60 millions of lbs. America nearly as much. Great Britain consumed about 600,000 bales, or nearly 280 millions of lbs. China imports 400,000 bales from British India, besides its own growth.

One pound's worth of silk, in silk goods, was worth in France, in 1825, £2 7*s.*; of wool, £2 3*s.*; of hemp, £4; of linen and lace, £5; of cotton, £2 3*s.*; of copper and lead, in sheets, £1 5*s.*; of bar-iron, as muskets, £9 2*s.*; as horse-shoes, £2 11*s.*; as table-knives, £3 14*s.*; as bolts, £8 10*s.*

Worms, in eating, prefer the white to the red, and the red to the black. The tree is raised by cuttings, layers, or by seed and transplanting. No other insect eats the leaves. In 8 days, it is 3 days in its first moulting. In 5 days, its second moulting takes place; in 5 days a third; and in other 5 days a fourth. In 3 or 4 days, it encloses itself in its cocoon, and becomes a chrysalis. In all, 29 or 30 days. They require a temperature of 65° to 70°. Eggs at 45°.

It remains in the chrysalis form for 2 to 4 weeks, and escapes from the cocoon by dissolving the gum which holds the threads (and by their rupture,) as a large moth. Each female lays about 350 eggs, and 391,680 weigh a troy lb. But full-grown, 50 weigh a lb., or have increased 9000 times. In a few days they die.

In 1000 oz. of cocoons, the pure silk is but 150, and in reeling but 100 or 80. 240 cocoons weigh a troy lb. of 5760 grains. An oz. of eggs yield about 1200 oz. of cocoons. 5 lbs. of reeled silk has been produced in England, from 12,000 worms. 97·5 lbs. avoirdupois of mulberry-leaves yield 10 oz. of reeled silk, or 156 to 1. Cocoons from lettuce-leaves are one-seventh less, and the worms die. The coarse floss is a twentieth of the pure cocoon. The length of fibre in each cocoon varies from 300 to 600 yards. 12 lbs. of cocoons, of 3 grains each, from 2800 worms, and 156 lbs. of leaves yield, on the average, 1 lb. of reeled silk, from which is made about 15 yards of gros de Naples.

Every fibre of silk will sustain 50 grains.

One-third of our exports of silk manufactures is to the United States, and a sixth to Canada and the West Indies.

Spitalfields still manufactures 3-7ths of the broad-silks, and Manchester 2-7ths. Coventry and Macclesfield are the chief manufactures of ribbons, worth 1¾ millions, and equal to 1-5th of the whole consumption. The duties, in 1836, were 214,898*l.*

We pay nearly 20*s.* per lb. for our silk, and our national returns depend on repayment for our exports of 1-5th to all parts of the world.

Not less than 4000 lbs. of raw silk are used weekly, for making sewing-silk, which employs above 2000 hands, at 8 or 9*s.* per week.

A reduction of duties on raw and organize silk, in 1825, has greatly increased the manufacture, which, subject to oppressive duties, could not compete with French fabrics. Of raw and thrown, we imported, in 1836, 2,130,000*l.*, and of foreign manufactures but 774,000*l.* worth; while we exported 367,000*l.* and of British manufactures 973,478*l.*, and 117,334*l.* of raw, thrown, and waste.

The annual consumption is estimated at about 4 millions of lbs., of which nearly 2 is in piece goods; a fourth in ribbons and handkerchiefs, and a twentieth in sewing-silk, at a cost of 17*s.* the lb., exclusive of 2*s.* for throwing. The cost of labour in all branches, winding, weaving, dyeing, &c., is about 3¾ millions, divided among 160,000 at an average of only 8*s.* per week. The returns are 10,500,000*l.*, leaving 2¾ for machinery, profits, &c.

LINEN.—The annual value of all linen fabrics was, in 1838, eight millions, of which 3½ were wages.

The woollen trades employ 400,000 hands.
Manufacturers' Petition.

Ireland, since the revolution, has enjoyed a preference in the manufacture of linens; but cotton goods, and spinning by steam power at Leeds, &c., have much interfered with Irish skill and industry. In 1825, the export of Irish linen had risen, since 1800, from 34 millions of yards to 55 millions. Sail-cloth is 2½ millions of ells. Irish exports to foreign parts were, in 1821, 4 mil-

lion yards, and they continue from 9 to 10 millions. Till 1824, the Irish linens produced 2½ millions sterling, of which above 2 were from Ulster.

The imports of flax vary from 3-4ths of a million cwt. to 1½ cwt., chiefly from the Low Countries. There are about 360 factories, above half in Scotland, and they employ about 36,000 hands, about 1-6th children. The most considerable are at Leeds, as Marshall's, Benyon's, and Atkinson's.

The flax used in England, and much of that used in Ireland, is imported from the Netherlands, Germany, and Russia. The former only answers for fine fabrics. Nearly the whole is spun by machinery, for which here are several extensive erections at Leeds, and they far transcend in fineness what can be performed by hand. It is now common to spin 200 leas to the pound, and even from 200 to 300, each lea being 300 yards. Flemish flax is of a slate colour, German is of a deep brown, Russian is light brown. They are whitened by a bleaching process. Dunfermline, in Fifeshire, and Barnsley, in Yorkshire, are the two chief seats in Great Britain of linen manufactories.

Belfast has nineteen mills for spinning flax. Machinery destroys the domestic manufactures. In other parts there are twenty-two others. Belfast has also about six cotton factories, and other parts twenty; together they employ 11,000 hands, about half children. There are, also, in Ireland, 46 woollen and worsted factories, without profit, chiefly south. In all, about 113 spinning factories.

The linen exported, in 1835, was about 70 millions of yards, value 3¾ millions, or about 1*s*. 1½*d*. per yard.

Ireland produces about 350,000 lbs. of long coarse wool, for worsted and inferior cloths.

Irish wheat is ground near Dublin, and there are great breweries at Dublin and Cork, for exportation of superior porter.

HOSIERY.—The plain stocking-frame was invented about 1590, by the Rev. Mr. Lea of Woodboro', near Nottingham. For want of encouragement he removed it to Rouen, but died poor in Paris. His workmen returned to London, and got a charter under Cromwell, and frames were set up at Nottingham and Leicester. After the Revolution it became a small manufactory for thread and worsted goods, and, as frame and knit stockings produced a similar price, handsome fortunes were made at Nottingham, Leicester, and Derby. It is now as extended to point lace, and in silk, cotton, thread, and worsted hosiery, and many fancy articles, a great trade, though very low in profits.

Filkin estimates the stocking-frames at 33,000, which make 3½ million dozen of silk, cotton, and worsted hose, valued, respectively, at 241,000*l*., 880,000*l*., and 870,000*l*., or nearly 2 millions. This branch employs about 70,000 men, women, and children. The quantities are nearly 2½ million dozens cotton, 1 million worsted, and ¼ million silk. The produce, per narrow-frame cotton, is 40 dozen per annum; wide, 300 dozen. Worsted, narrow, 75 dozen; wide, 150; silk frames, 30. Nottingham, Leicester, Derby, and Loughborough, are its seats.

Silk hose employs, per Filkin, between 6 and 7000 persons, and consumes nearly 4000 lbs. per week.

In the stocking trade of Leicestershire, there are 14,000 stocking frames and looms, which employ 28,000 hands. The labour at 6*s*. per week, and materials are worth a million per annum.

MISCELLANEOUS.—Owing to a remission of the GLASS duties, the exports have greatly increased, and glass-cutting has become an extended employment. It is first wrought by iron wheels and sharp sand, then smoothened by stone wheels, rotten-stone, and pumice, with willow-tree wheels. Putty gives its finish.—*Jones*.

An abatement of duty, in 1834, on plate-glass, has much extended that manufacture, and shops in London have plates 7 feet square, while those a yard square are seen every where. The principal rooms of many private houses, also, have plate-glass, often a pane to a sash, or 4 feet by 3; cheaper in use than the slight brittle crown-glass. The exports, since the abatement of home duty, have risen nearly half, owing to the improvement and ease of trade. The whole weight of all kinds of glass made, per annum, is about 30,000 tons, of which bottle-glass is 2-3ds. The exports are about 15,000 tons, chiefly to India, the United States, and Brazil. The duties, in 1836, were 683,237*l*.

Of flint-glass about 55,000 cwts. are made annually; of plate, about 30,000 cwts.; of crown, about 118,000 cwts., and of bottle-glass nearly 200,000 cwts.

The largest plate of glass made by the British Company is 13 ft. 4 in. by 6 ft. 8 in., and the price when silvered 247*l*. At 11 ft. by 7, the price is 200*l*.

Wedgwood was the improver of our Pottery trade. Within 70 years, our best fabric was brown and black pans, and Staffordshire ware. We now make the finest porcelain in the world, and export half a million worth, in nearly 50 millions of pieces. Burslem, Hanley, Stoke, &c., employ 30 or 40,000 persons, and Derby, Worcester, Lambeth, &c., also make the prime ware. The gold, alone, used in gilding is not far short of 1000 lbs. per annum. The best material for clay is brought from Cornwall and Purbeck, with flints from Kent, &c. It also employs some hundred artists.—*Shaw*.

Porcelain clay is decomposed, or incipient feldspar, *i. e.* 3 silica, 1 alumina. Potters' clay is 6½ silica, 5¼ alumina, ¼ lime, 1-6th oxide of iron, and 3 water. Clay from hornblende has less alumina. Stourbridge clay is infusible, because mere alumina and silica; but lime, or much oxide of iron, renders clay fusible.

English porcelain is made of feldspar, detached from Cornish granite, by trituration and washing; and the silex, ground flint, and soap-stone, from the Lizard.

Jewellery is a considerable manufacture in London, where 4500 hands are employed,

and only about 700 in other parts of the United Kingdom. They consume above 24.000 lbs. troy, of pure gold, and full 150,000 lbs. of silver in various works. Gold and silver plate, also, absorbs 500 lbs. of gold and 106,000 lbs. of silver, on articles of which 4-5ths are made in London. In all, nearly 2 millions worth of gold and silver for trinkets and ornamental furniture. In general, they melt sovereigns for these purposes, alloyed to two-thirds pure gold, so that a lb. of jewellers' gold is usually worth but 16 carats, or 31*l.* 3*s.*

About 1·2 million oz. of silver plate are manufactured in England, per annum, and about 5200 oz. of gold plate.

The manufacture of paper used for writing and printing, is nearly 60 million lbs. per annum, and taking it at 18 lbs. to the ream, this gives a consumption of 3½ millions of reams. Of whited brown and brown paper, the production is 18 millions of lbs., and at 20 lbs. weight, this gives 900,000 reams. Dividing the production, nationally, England makes 90 parts, Scotland 15, and Ireland 3½, though Scotland sends large quantities to London. The duties, in 1836, were 831.000*l.*

Soap is a great manufacture The United Kingdom makes 148 million lbs. of hard soap, and 12½ of soft soap; 6 7ths in England. The export is but 13 millions of hard, and 9000 lbs. of soft. Manufacturers claim a drawback on 7 million lbs of each sort. The duty was 3-4ths of a million.

Every ton of soap consumes 12 cwt. of tallow, and soap consumes 28,000 tons per annum.

An ox yields 70 lbs. of fat, and a sheep 13 lbs., equal in a year to 90,000 tons over the imports from Russia, &c.

The whale-oil produced, per annum, was, in 1814, 33,567 tuns, of 252 gallons; but, latterly, was but 20,000 tuns per annum.

Sixteen tons of hides and skins are annually imported, at a custom-house value of 1½ million, for conversion into leather, and these with home produce make 30,000 tons of leather, worth 5 millions. Twice the value is believed to be expended in labour and profits, or 10 millions. This gives employment to 133,000 shoe-makers, to 30,000 tanners, &c.; to 12,000 saddlers, and to 25,000 glove-makers, of all ages. A large shoe-trade exists at, and near Northampton, and a glove-trade at, and near Worcester; but, we besides import 1½ million pairs of gloves from France.

Thirty-four lbs. of raw sugar make 20 of refined sugar, with 13 cwt. of waste molasses, &c. We export about 20 tons of refined sugar, chiefly to Italy. The gross import of sugar, in 1836, was 222,762 tons, and we re-exported 30,000 tons, partly raw and partly refined, as 34 to 20. The mean price, in 1836, was 1*l.* 11*s.* 5*d.* per cwt., or nearly 3½*d.* per lb. The duty was 4,947,670*l.*

Sugar and water, in equal weights, ferment in a warm place, and are turned into carbonic acid gas and alcohol. 100 parts yield 57·1 alcohol and 43 carbonic acid gas. And alcohol is 52 carbon, 34 oxygen, and 14 hydrogen; and carbonic acid is 27 carbon and 73 oxygen. White sugar is carbon 43, oxygen 50, and hydrogen 7 And water, oxygen 87½ hydrogen 12½. Then the carbon

in the *sugar* is....		2150
The oxygen		2500
The hydrogen		350
		5000
And the oxygen in the *water*..	4350	
And hydrogen	650	
		5000
		10,000

At the same time, the *products* in alcohol and carbonic acid gas are

Carbon	4125
Oxygen	5077
Hydrogen	798
	10,000

Much beet-root sugar is now made in Austria.

BREWING—(The British Wine Trade) employed, in 1837, 107 brewers in London, and 2269 in the country. The former consumed 5,641,470 bushels of malt, rather above the average, and the latter 16,765,313 bushels. There were, also, 26,867 brewing victuallers, who consumed other 8,812,117 bushels, and a further 3,683,324 bushels by others licensed. The Licensed Victuallers were 55,751.

The hop-grounds were 56,323 acres, and the malt, paying duty, was 33,692,352 bush.

The tax on malt, till 1717, was but 4*s.* per quarter. Pitt raised it, in 1787 and 1791, to 12*s.* 6*d.* The French war, in 1802, to 18*s.* 8*d.*; and, in 1804, to 38*s.* 8*d.*; but, in 1818, it was lowered to 20*s.* 8*d.* No other government would impose such a tax—the French would not tax grapes, nor the Chinese tea. The high price leads to the use of noxious drugs, and it appears that, from 1720 to 1730, 500,000 more quarters were used for 3½ millions of barrels, than from 1790 to 1800 for 6 millions. Most publicans, by drugs and mixtures, increase 2 brewers butts to 3! In 1720, every one of the population drank a barrel per annum, now not half; while gin has increased from 3 to 12½ millions of galls.

The present duty on malt is 57 per cent., on coffee, 63 per cent.; on wine, 75 per cent.; on rum, 400 per cent.; on spirits, 333 per cent.; on brandy, 627 per cent.; and, on Hollands, 930 per cent.—*Peele.*

The London Porter brewers produce 135 gallons from one quarter of malt, which, with duties and expences, cost 8*l.* 8*s.*, or nearly 1*s.* 3*d.* per gallon; the retailing, at 5*d.* per pot, leaving a profit of 5*d.* per gallon to brewer and publican. Without duties, the cost price would be 10*d.*; or, at lower costs of malt and brewing, 8*d.*

The specific gravity of ale is about 1·4; of brown stout, 1·01; and, of porter, 1·014.

Burton ale yields 8·88 spirit in 100 bulk. London 7·5. Edinburgh 6. Dorchester 5·6. London porter 4·2. Brown stout 6·8. Strong home-brewed ale 9·6.

Between 1720 and 1730, 500,000 quarters

more malt were consumed in brewing 3,733,000 barrels of beer, than from 1790 to 1800, in brewing 6,170,000 barrels: a proof of excessive adulteration.

Malt dried, at 119° is white, at 134° amber, and 148° brown. It loses from 8 to 10 per cent. in weight; but, in bulk, it increases from 7 to 10 per cent. One half the starch of the malt remains in the grains, for 100 lbs. of grains remalted weighs from 52 to 56 lbs. Malting germinates the grain, and the germination is stopt before the plant shoots; but the process converts the kernel into starch, soluble in water.

In brewing, the water is 180° for the first mash, and 190° for the second. In cooling, from 200° to 52°; worts lose about a fourth. In 151 parts of yeast, 136 are water, 3 saccharine matter, 2¼ alcohol, 2¼ mucilage, and 5 gluten, with some lime, potash, and acids.

Four or five bushels of malt, and 4 lbs. of hops, are usually employed in making a barrel of good family ale.

In grinding malt, stones will crush twelve quarters per hour; iron rollers as much; and large steel-mills, six or eight quarters. Beer, from pale malt, is made into the porter-colour by infusing burnt sugar, mixed with water.

In 1839, the net duty on malt, in England, was 4,274,663*l.*; and, in Scotland, 372,101*l.* The hop duty was 302,906*l.*

The greatest produce of hops grown, in 48 years, was 57½ millions of lbs. in 1826; and the least, in 1802 3,707,170 lbs.

Worts from 1·04 to 1·05 fall in gravity, by fermentation, to 1·0014 and 1·007.

Eight bushels of barley make nine of malt. A bushel of English barley weighs from 50¾ lbs. to 49¾ lbs., and of the same, in malt, from 40½ lbs. to 35 lbs. Scotch barley averages 52½ lbs. per bushel.

The weight of a grain of barley is 0·64 of a grain in weight, and its size 0·00208 of a cubic inch; the length being 0·343, the breadth 0·143, and the thickness 0·108.

The quantity of Spirits consumed, per head, in England and Wales, is $7\frac{1}{5}$ pints. In Scotland, 23 pints. In Ireland, 13 pints, besides the illicit distillations. The total quantity in the United Kingdom, on which duty is paid, was 31½ millions of gallons, in 1836, and the total duty was 5½ millions of pounds.

England imports, from Scotland, 2½ millions of gallons, and from Ireland 1-3rd of a million; and Ireland receives from Scotland nearly a million of gallons.

There are 12 distilleries in England, 260 in Scotland, and 87 in Ireland. 108 rectifiers in England, 11 in Scotland, and 19 in Ireland.

Six millions pounds worth of whiskey are annually consumed in Ireland.

The western counties are supposed to make 50,000 hogsheads of Cyder, and 1500 of Perry.

Grain, &c.—In the reign of James the First, wheat sold from 13*s.* 6*d.* to 21*s.* a quarter, and barley and rye from 7*s.* 6*d.* to 10*s.* In that of Charles II. and James II. wheat land let from 1*s.* 6*d.* to 2*s.* 6*d.* per acre. The increase of price, in 1800, to 30*s* and 40*s.* arose from the increase of currency and this increased speculative and prospective values. That which had been 2*s.* and rose to 40*s.* might be 80*l.* or 100*l.*, hence the object is to hold at any rate. But that which had been 80*s* fell to 4*s.* and it might fall to 2*s.*: the object, then, would be not to hold. This is the entire mystery of high and low prices in every thing.

Grain is a manufacture, which employs a man for every 60 quarters, or 16,600 men for every million quarters. The price of corn is in exact relation to the price of meat, and the profits of both are fixed by nature. The preference in cultivation is, whether, at market-prices, 226 lbs. of mutton, 187 of beef, or 3 or 4 quarters of grain, yield the best balance of cost and sale per acre.

Arthur Young computed the average price of wheat, barley, and oats, for different periods, taking the price, in 1810, as 20*s.*

From 1400 to 1500......3
1500 to 1600......5
1600 to 1700......8 75
1700 to 1800......10 25

Till 1766, a bounty was granted on exportation, 5*s.* on wheat, and 2*s.* 6*d.* on barley. But the political economist, Adam Smith, procured the abolition of the bounty, and, for the remainder of the century, less was cultivated, and wheat rose to 11¾; latterly to 14½; and, from 1804 to 1810, to 20*s.*

From the year 1773 to the year 1814, the total imports of grain were 30,430,189 quarters, and the exports 5,801,440.

The highest Annual Averages of Wheat, in this century, have been as under—

1800....	£5	10	5	1812....	£6	2	8
1801......	5	15	11	1813......	5	6	6
1810......	5	3	3	1839......	3	12	0

The lowest Annual Averages of Wheat have been as under—

1803....	£2	17	1	1823....	£2	11	9
1821......	2	14	5	1827......	2	15	0
1822......	2	3	3	1834......	2	2	0

The result of the corn-laws will appear from the following statement of the imports of corn in the last 15 years, contrasted with the imports in the preceding 15 years, divided into periods of five years each:—

In the 5 years ending	*Quarters.*
1805	7,365,184
1810	6,933,975
1815	5,931,693
Total....	20,230,852

In the 5 years ending	*Quarters.*
1820	13,866,973
1825	10,356,958
1830	32,151,425
Total....	56,375,456

A barrel of flour of 196 lbs. is considered, in duties, as equivalent to 38½ gallons of wheat; 181½ lbs. of oatmeal to one quarter of oats.

Baking is an invention by which the meal of grain is, by fermentation and evaporation, brought into the convenient substance of bread.

A pound of wheat-flour consists—of bran 3 oz., starch 10 oz., gluten three-quarters of an ounce, and sugar one-quarter.

Wheaten bread, marked with a *W*, is made of the finest flour; standard wheaten is made of the whole flour, mixed; and, household, marked *H*, is made of the coarser flour.

Good flour absorbs more water than bad, and old flour more than new. Hence, from the first sorts, 5 or 6 loaves more are often made from a sack of 280 lbs. When alum is used, to indulge consumers with artificial whiteness, equal quantities of salt and alum are introduced. A quarter of wheat of 8 bushels yields 7 kinds of flour, as under:—

	Bushels.	*Pecks.*
Fine flour	5	3
Seconds	—	2
Fine middlings	—	1
Coarse	—	¼
Bran	3	0
Twenty-penny	3	0
Pollard	2	0
	14	2¼

It is found, when economy of wheaten flour is desirable, that 1 lb. of rice goes as far, in satisfying hunger, and in nutriment, as 8 lbs. of flour; and that 2 lbs. of potatoes are equal to 1 lb. of flour, and equal to four of turnips or carrots. Five lbs. of boiled potatoes, mixed with 20 lbs. of flour, make as good bread as can be eaten. Bran, boiled in the water used for kneading the dough, greatly increases the weight.

The quartern-loaf was 5¾*d.* in 1779, and wheat 5*s.* 2½*d.* per bushel; in 1795, 12½*d.*; in 1800, 17½*d.*, and wheat from 10*s.* to 22*s.*; and, in 1812, 18½*d.* Its average was 6¾*d.* from 1765 to 1794; and, during the war, it averaged 14*d.*

One peck of seed-wheat produces an average crop of 2 bushels; but, by separating and transplanting the roots of a single grain of wheat, 500,000 grs. have been produced. France, Poland, &c. produce 5 or 6 to 1, and fertile parts of France 15 to 1. In South America, from 12 to 24 to 1. In Nigritia, 50 to 1.

Two bushels of seed in England produce 18 of wheat, 4 of barley, and of potatoes 190 bushels in fair crops.

The quantity of seed used in dibbling is from 1½ to 2 bushels per acre: by broad cast it is 2½ bushels per acre.

1000 parts of wheat yield 740 parts of starch, barley 790, rye and oats 640, peas 500, beans 420, potatoes 160 to 200, beet, parsnips, carrots, turnips, &c. under 75; grasses from 65 to 20. Wheat, rye, and beans most gluten. Beet, parsnips, carrots, barley, and turnips, most sugar. Wheat and barley most soluble matter.

Wheat, in America, averages 36*s.* per quarter. 40*s.* is the highest.

Every member of the population is considered as consuming the flour of a quarter of wheat per annum; and, of the flour of other grain about two quarters.

In France, they estimate the daily consumption of bread, including that used with soups, at 2½ lbs. per person, whilst, in England, it is not quite 13 ounces.

There being about 24 millions of quartern-loaves, per week, eaten in the United Kingdom, a half-penny per loaf, more or less, is 50,000*l.* per week, or 2,600,000*l.* per annum, and so with every half-penny assessed on the population.

The average import of foreign corn has been 700,000 quarters.

Ireland exports to Great Britain nearly 2 millions of quarter of grain, chiefly oats, per annum.

Bread may be sold, if made of the flour or meal of wheat, barley, rye, oats, buck-wheat, Indian corn, peas, beans, rice, or other grain, or of potatoes or any of them, such ingredients being mixed with any common salt, pure water, eggs, milk, barm, leaven, potato, or other yeast, butter, seeds, or sugar, in such proportions as the bakers may think fit, but with no other ingredient whatsoever. It may be made of any weight or size; but, it must be sold by weight, and in no other manner.

Bakers must use avoirdupois weights, and provide frames, scales, and weights.

Dantzic has an unrivalled trade in wheat—the white of Poland and the red of Prussia. From 1000 to 1200 loaded vessels depart annually, of which 850 are for Great Britain.

Odessa wheat is preferred in the Levant to British wheat, and that brought from Taganrog is preferred for maccaroni, vermicelli, &c. It is 10 per cent. heavier than our wheat, from having much less bran. The price at Odessa averages 28*s.* 6*d.* and the expences 18*s.*

In toys, and fine mechanism, the Chinese are highly ingenious, and imitate with readiness the most curious productions of European workmen. They make little or no use of machinery; it is constantly discouraged by the government, as interfering with the subsistence of the people.

The arts of Europe, which have been carried to perfection in the last century, were as perfect in China, 1000 years ago, as in Europe now. The common people were clothed in silk, while the people of Europe wore woollen cloths as coarse as blankets. The Chinese ladies enjoyed a superb toilet and costly trinkets, while wooden skewers were used instead of pins; and, when oats and turnips were first grown in Europe, China enjoyed luxuries of our improved horticulture. If Europe has excelled them, it has been chiefly by imitating them and the Hindoos.

The Chinese appear, beyond doubt, to have made many of the important inventions claimed, in dark ages, by sundry Europeans. They invented the cycle of 60 years, before the use of the epoch of the Olympic Games. They printed from blocks

so early as the 10th century; they used the magnet before the year 900; they have used gunpowder, for fire-works, as long since as the Christian era, and make it exactly in our proportions; they have had original spectacles, of crystal beads, from time immemorial, also concave reflectors, on varieties all their own; they invented paper in the first century, and their language proves that the written character was borrowed, and not even improved, by the Phœnicians. Many of the Chinese arts cannot be imitated even to this day, much as we, on the contrary, excel them in particular inventions.—*Davis.*

The vine flourishes between lat. 25° and 48°, and in America from 20° to 38°, and below 3000 feet. It succeeds best in volcanic countries, and in light soils with a south-east aspect.

Port is produced chiefly in Upper Douro, and is mixed, for exportation, with 23 per cent. of spirits of wine. Its quantity 30,000 pipes.

Sherry is produced near Xeres, in Andalusia. Its quantity 15,000 pipes.

The United Kingdom imports from 6 to 8 millions of gallons; Madeira as 1, Cape 2, French 1½, Portugal 12, Spain 8, others 1¼.

The teeth of a saw-mill may move 8200 feet per minute.

The salt-work at Wallac, in Sweden, operates by evaporation, and has a mass of brushwood, 40 feet high and half a mile in length.

10 lbs of salt, 12 of manganese, and 12 of sulphuric acid, form bleaching powder.

Suhbingen, called a German Birmingham, has 4 smiths, who employ 20 or 30 men, and make about 6000 scythes per ann.—*Trollope.*

Dupin estimates that the British steam-engines could raise from their quarries, and place the stones, in the Great Pyramid of Ghiza, in 18 hours.

As competition is the destruction of profits, and, finally, of trade itself, so its corrective is the licence system, which limits operations, and secures to each a productive position in society.

Certain chemists make it a trade to supply pernicious drugs to brewers, wine and spirit merchants, publicans, grocers, and oilmen. *Accum.*

Other chemists make all the patent medicines, and imitate all the staple drugs and pharmaceuticals, with little regard to quality or ingredients, with which they stock the chemists' and other shops.

Lead is used by wine-merchants to stop the ascetic fermentation of wine, and to render muddy white wines transparent. Alum, in large quantities, is used by bakers to bleach bread so as to gratify the fancy of consumers. Beer, by most public brewers, is made of malt, hops, liquorice, treacle, burnt sugar, salt, cocculus Indicus, capsicum, poppy-heads, copperas, alum, quassia, tobacco, nux vomica, grains of Paradise, ginger, &c. &c.—*Accum.*

In 1839, the manufacturers took alarm at the great increase of the exports of yarns, threads, &c. evidently for weaving and finishing in foreign countries, by which our spinning machinery was made to subserve their industry. It seemed even to extend to pig-iron and metals, and to threaten all manufacturing employment. It ended in the reduction of hours and days of labour in most factories, but the full effect will not be felt for a few years. It is, at the same time, certain that, in all raw fibrous articles, France, Prussia, Russia, Switzerland, the United States, &c. have greatly increased their imports; and this policy threatens our exports, or drives our merchants to the worst markets.

In 1838, England imported 82,000,000 of lbs. of cotton more than in 1837; but other nations, also, increased their imports proportionally, and, if manufactured, it would be to glut the markets, or increase competition. The buying foreign materials to manufacture, which other nations can buy and manufacture, is, therefore, but a temporary system of advantage, or half a century's monopoly.

The law of 1624, setting employments free, was the basis of our manufacturing system, and of universal competition, till a limit takes place.

Such is the present ascendancy of manufactures on the continent, that Russia, which, in 1834, received from one British house 345,000 yards of velveteens, in 1837 took but 8000; while the article made at Moscow is equal to any of British manufacture. So Prussia, which used to receive millions of yards of our cotton fabrics, does not now import a single yard. It is the same with these as with other fabrics in other countries. Even, as to many articles, dealers can import foreign fabrics, and re-sell them in England at higher profits than they can make at home. Our 50 years' monopoly of trade and manufactures is, therefore, at an end. The primary cause is the interest of the national debt, 29½ millions, and the shifts to throw it from property upon industry.

Foreign nations have been goaded to buy and copy our machinery, so as to become manufacturers, by the vast wealth which flowed into England from the monopoly, and by the employment which it affords to their own superfluous population; hence, great advantages in capital, and many privileges, are afforded to all British artizans and operatives who present themselves for employment; then, the low price of provisions enables them to compete with us in every market.

The course of a public manufacturing system is terminated by the limit of credit, and the foreclosing of its own artificial capital. We buy raw materials, manufacture them, and then have to find and force markets. Payments are certain, competition destroys profits, credits in foreign markets are ill kept, or prove bad debts, and these, with stocks in hand, absorb capital, till the system comes to a stand. If luxury accompanied, and imports exceeded, exports, insolvency and bankruptcy result, and the tem-

porary prosperity is soon mere matter of history. In all respects, a nation resembles a private establishment, in its rise, decline, and fall.—*Phillips.*

The monopoly of farms, and the impulse of the manufacturing system, have enlarged the proportion of the manufacturers from 6 to 5 in 1801; to 8 to 5 in 1821: and to 2 to 1 in 1831. The population has increased nearly 30 per cent and the manufacturers 40.

If public policy destroys a manufacture, the capital cannot be diverted, and the operatives find other employments. Habit, skill, connexions, and arrangements, render it always difficult, and generally ruinous. In practice, it is preferred even to seek a new country.

Baron C. Dupin has made an estimate of the amount of animate and inanimate force applied to Agriculture and Manufacture in France and Great Britain.

The 33,800,000 inhabitants of France are equivalent to a power of 13,900,000 males at the age of vigour. In France, *two-thirds* of the population are employed in agriculture; and a *third* in manufacturing and commercial pursuits. Hence, France possesses—

Human agricultural power..	8,506,038 men
Manufacturing and commercial................	4,403,019

			Effective Labourers.
Human race, two-thirds		=	8,406,038
Horses........	1,600,000	=	11,200,000
Oxen, &c.	6,973,000	=	17,432,000
Asses	240,000	=	240,000
Men's power as			37,278,038

The agricultural force of Great Britain is—

	Effective working men.
Agricultural force..........	2,132,446
And the professions	4,264,893

The power of animals is as follows:—

			Effective labourers.
Human race, one-third ..		=	2,132,446
Horses	1,250,000	=	8,750,000
Oxen	5,500,000	=	13,750,000
Total....			24,632,446
Ireland, approximation			7,455,701
United Kingdom....			32,088,147

Hence, the agriculturists of Great Britain have a force *twelve* times their personal force; while the additional force obtained by the French does not amount to *five* times their personal force. In France, there are 113,300,000 acres of productive land; hence, there is an animate power equal to 1 man to every 3 acres nearly. The productive land in Great Britain is 34 million acres to 24,632,446 men, or 1 man to 1 38 acres.

The human force in France, employed in commercial and manufacturing industry, is equivalent to 4,203,019 working men; to this power must be added that supplied by the use of horses, computed at 300 000, whereby the animate force of France is raised to 6,303,019 power of men.

The human force of Great Britain, employed in commerce and manufactures, is 4,264,893 men; to this must be added 250,000 animals, which will raise the animate force to 6 014,893; to which, superadd the approximate value of 1,260,604 effective men for Ireland: so that the commercial and manufacturing animate power of the United Kingdom is 7,275,497 labouring men.

The total number of mills in France is 76,000, about 10,000 of which are windmills. The total force employed for forges, furnaces, and machinery, is equal to the third of the 10.000 windmills; the wind employed in navigation is equivalent to the power of 3,000,000 men; and the steam-engines in France exceed the power of 60,000 dynames, equivalent to the power of 480,000 working men turning a winch; for the *dyname* is the force exerted by 8 men at a winch to raise in a day 2205½ lbs. 1094 yards high.

Besides windmills, machines, &c., Great Britain possesses in steam-engines a moving power of at least 800,000 dynames, or of 6,400,000 men at the windlass. The whole is as follows:—

	France.	Gt. Britain.
Animate force	6,303,019	7,275,497
Mills and engines ..	1,500,000	1,200,000
Windmills	253,333	240,000
Wind and sails	3,006,000	12,000,000
Steam-engines	480,000	6,409,000
Men's power	11,536,352	27,115,497

The taking Ireland at 1,002,667, the men's power in the United Kingdom is 28,118,164.

FRANCE.

[The number of Facts furnished by French Staticians, will justify the Editor in assembling the chief of them under a special head. The same reason has led to a similar disposition of United States articles. Comparative information will be found under the General Heads of the volume.]

France lies between the 43d and 51st degree of latitude, contains 132 millions of acres, and is a country of great production, enjoying the finest climate.

The Government of France has published, from official returns, the following circumstances of that kingdom:—

It contains 86 departments, 363 arrondisements, 2834 cantons, 37,189 communes, 52,760,279 hectares of taxable land, (130½ millions of English acres) or 26,709 square leagues, at 2000 nearly to the hectare, or 5009 nearly to the acre.

The taxable land is to the whole as 498 to 527, and the remainder is in roads, rivers, unproductive, and cemeteries.

The houses, &c., are 6,642 416, which pay some tax; the mills 82.575, the manufactories 38,030, and the forges, &c. 4412.

The proprietors are 10,896 682, the farms or divisions of estates are 123 360,336.

The census of 1831 gave 15,940,105 males and 16,629,118 females—total 32,569,223.

Of these 8,866,423 were boys or unmar-

ried, and 9,069,923 girls or unmarried. 722,611 were widowers, and 656,836 widows. The military were 303,231. The towns contained 2,772,670.

The births in 9 years, to the end of 1832, were, legitimate 903,680, illegitimate 70,244, and foundlings 33,549, making the illegitimate 1 in 13 legitimate, and the foundlings 1 in 30. But, in Paris, the ratios were 5 to 11, and 1 to 7½. The cost of foundlings is 82 francs per annum.

The embassies and consuls cost 4,393,318 francs, the secret service 700,000.

Three millions of francs are allowed to colleges and scientific institutions.

1,760,621 francs are paid to improve the breeds of horses.

34½ million francs are paid for roads and bridges, 4 for public works, and 2 in aid of the theatres; 1 to benevolent institutions.

27 millions in building, &c. ships of war.

The gendarmerie, or armed police, 17 millions.

The public debt and sinking-fund cost 332,631,124 francs, or 13½ millions sterling, received by 213,168 persons, on 5, 4½, 4, and 3 per cent. rentes.

The French consols, or rentes, are 186,110,978 francs; the life annuities are 5,760,960, and the pensions are 60,375,245, chiefly military.

Various charges on the debt, made by Napoleon from 1805 to 1815, amount to 9 millions of francs, to the senate, the legion of honour, 10 marshals, 25 generals, his brothers, &c. &c.

140 millions of francs have been guaranteed by government, borrowed by companies for canals, &c.

In 1799, the 5 per cents. fell to 7, and in 1834 averaged 105 49; from 1807 to 1812, they were 80.

The metallic circulation of France is not less than 75 millions sterling, and is often estimated at half as much more, and even double.

All the property of France was estimated, in 1832, at 3385 millions of francs. In 1788, at only 2000; but the property is the same.

The arable land of France is taken at 76½ millions of acres, and the pasture, &c. at only 25; the vineyards at 5, and the forests at 17:—the unimproveable is 9, making 132½ millions of acres, or 53½ millions hectares.

From 1700 to 1780, the mean duration of life in France was 28; and, since, it is at 36.

At 25, married French women have an average 36 to live, and unmarried but 31. 72 married live to 50, and only 52 unmarried. 78 married men live to 40, and only 41 single. 48 married men live to 60, and 22 unmarried. 27 to 70 against 11 and 9 married, to 80 against 3 single.

In 14 years, the annual average of births, in France, has been 967,533; deaths 783,268; and marriages 236,996. Their illegitimate are 1 in 13, or 13·2. (In England and Wales, 1 in 19.) The males born are to the females as 16 to 15. There are 3·8 children to every marriage. The annual deaths are 1 to 39 7 on the population. The annual births 1 to 32 2.

The towns in France, with above 20,000 inhabitants, in 18:1, were as under:—

Troyes	39,143
Marseilles	145,115
Caen	39,140
Aix	22,575
Arles	20 236
Dijon	23,552
Besançon	29,167
Brest	29,8 0
Nismes	41,266
Toulouse	59,630
Bordeaux	109,467
Montpelier	35,825
Rennes	29,680
Tours	23,233
Grenoble	24,888
Nantes	87,101
Orleans	40,161
Angers	32,473
Rheims	35,971
St. Etienne	33,064
Nancy	29,783
Metz	44,416
Lille	69,073
Dunkerque	24,973
Arras	23,419
Boulogne	20,856
Clermont	28,257
Strasbourg	49,712
Lyon	165,459
Paris	774,338
Versailles	28,477
Rouen	88,086
Havre	23,816
Amiens	45,001
Montauban	25 460
Toulon	28,419
Avignon	29,889
Poictiers	23,128
Limoges	27,070

The Bank of France has a capital of 68 millions of francs. It issues only notes of 1000 and 500 francs, and discounts bills at three months, with three names. The currency of France is altogether metallic; and, hence, there are not the British discrepancies in real property over labour.

Such is the prosperity, credit, and solid wealth of the Bank of France, that the idea put forward of its lending its acceptances to assist the Bank of England in meeting the adverse exchanges in 1839, created little revulsion of national pride. No such shift can, however, be useful to a country which, in 1839, imported for luxurious home consumption 59,878,905*l.*'s worth; and exported in mixed articles a total of only 49,640,896*l.*

The Bank of France is in 67,960 shares or actions of 1000 francs each, about 2¾ millions sterling, and there are 11 other banks.

The Bank of France pays 11 per cent. dividend. In 1836, it discounted 406,000 bills, average 1868 francs; and, in 1838, 576,000 bills, average 1390 francs, besides 68,000 of only 200 francs. Its mean circulation is about 220 millions of francs.

The revenues of France, for 1838, were

1,155,329 168 francs (46 250.000*l.*), and the expenditure 1,116 691,601 francs.

The public debt, or rentes of France, on Jan. 1, 1839, were 195,916,901 francs, held by 264,833 persons.

The gross total revenue of France, on the average, from 1814 to 1832 inclusive, was 1,016,303,086 francs, or 40⅔ millions sterling, of which the taxes produce 36½ millions.

Direct taxes, land, &c	351
Registration, stamps, &c	166
The forests, &c.	24
The Customs	132
The Post-office, &c.	44
Small taxes	13
Indirect taxes	190

Of the last, the sale of tobacco and snuff yields 6½ millions; lotteries yield 15 millions, and salt 54 millions of francs.

The French debt is 5417½ millions of francs, or 216,700,000*l.*

The average expences are 39½ millions. The Minister of Justice expends 19 millions, of Religion 32, of Foreign Affairs 10, of Instruction 3½, of Commerce 9⅗, of Public Works 94, of War 253, of Marine 69, and of Finance 558. The internal administration, taken by itself, costs 48 millions. The interest of the unliquidated public debt is rather above 10 millions sterling.

France produces altogether 1060 millions of gallons of wine, worth nearly 1000 millions of francs, or 40 millions sterling; and about 25 millions of gallons of brandy and spirits, worth two francs per gallon, besides vinegar. They employ 3 millions of people. The vineyards near Bourdeaux yield a million of hogsheads of wine, of which 100,000 are converted into brandy. The red sorts sell, on the spot, from 3000 francs to 300 per ton of four hogsheads.

In France, beet-root yields from 30 to 35,000 lbs. per acre, which produces 7 to 8 per cent. of sugar, or 2 lbs. of sugar for every 1 lb. of wheat on the acre. Isnard, under Napoleon, in 1811, was the first cultivator. In Massachusetts, an acre has yielded 40 tons, or 90,000 lbs. and 5400 lbs. of sugar, *i. e.* 3 of sugar to 1 of wheat. An engine of 10-horse power rasps 15 tons per day, and the expense is under 15*l* for 50,000 lbs. of sugar. The pumice, 20 per cent. of the whole weight, feeds cattle. The sugars are of the most delicate quality.

In 1836, the coal-mines of France produced 26½ millions' worth of francs; and the iron and steel was 125 millions of francs' worth. Alum-works produced 1⅗ millions' worth. These and other minerals produced about 6½ millions sterling. The department of the Loire 813,000 tons of coals, and the North 531,000 15 other departments yield from 12 to 150,000 tons.

France has 46 coal-fields, and 258 coal-pits, which yield nearly 2 million tons of coals. The largest in the department of the Loire yields 1 million of tons and the next department of the North above half a million.

Wood-charcoal sells at 55*s.* per ton, coal 18*s.* 6*d*, coke 20*s.* per ton, and wood 50*s.* per corde.

France, also, has 10 lead mines, which yield 2 tons of silver, and 800 tons of lead and litharge. There are, also, 9 small copper-mines, and some of antimony and manganese. There is also produced about 400,000 tons of salt, of which 50,000 are exported, besides alum and copperas work. The total value is 5 millions.

France also yields 5 million pounds' worth of iron and steel, which, when manufactured in 1838 9, was half a million of tons.

The whole of her mineral products are worth 12 millions per annum.

France has arrived at great perfection in woollen manufactures. It imports 20 million francs' worth of wool, and exports to the value of 60 millions, or 1½ millions sterling.

France spins and weaves about 100,000 lbs. of cotton wool, or double within 18 years, at a cost of 8*d.* per lb., and she exports 2½ millions sterling of manufactures.

France produces at least 3 millions lbs. of silk of the best quality, and 1 million lbs. are imported. Latterly, improved means of rearing the worms have been adopted, and the quantity rapidly increases.

France produces 45 millions of quarters of various grain, ⅗ for man, and ⅖ for beasts, seed, and distillation.

The quarries of France employ 70,396 workmen, and yield above 1½ million sterling. 71 salt-works produce half a million sterling.

Crystals and glass produced 1,900,000*l.*; bricks and tiles 1,200,000*l.*; pottery, &c., 2 millions; copper, zinc, and lead, 1,200,000.

The French commercial shipping are 15,023, with an annual increase of 62, and the tonnage is 647,107, decreasing 5883 tons. Including foreigners and coasters, 73,442 enter, and 71,035 clear per annum. They have but 1 ship of 800 tons, 14 from 500 to 800, 1739 from 300 to 100, and 10,518 below 30 tons.

France has 5 colonies, Martinique, Guadaloupe, Guiana, Bourbon, and Senegal, which contain 80,000 free, and 294,434 slaves, with 1318 sugar plantations, 2469 coffee, and 570 cotton, spice, &c. They have, also, 5 settlements in India, with a population of 150,000. The imports from the colonies are about 2 millions sterling.

France imported from its colonies in 1835, 71½ millions of francs, and from other nations 689½. She exported to her colonies 52⅗, and to other nations 781⅗. Balance in her favour 73⅗ millions of francs. The duties in the importations were 102½ millions.

Its harbours are Dunkirk, Calais, Boulogne, Dieppe, St. Malos, Cherburg, Havre, Brest, L'Orient, Rochelle, Rochfort, Bordeaux, Bayonne, Toulon, Cette, and Marseilles.

In 1838, the French colonial sugar was 14 millions of kilogrammes, coffee 2⅗ millions, cotton 14⅗, olive-oil 9½ millions of quintals.

In 1836, the exports of France were 38,451,390, *exceeding those of the United Kingdom by 2 millions;* and the imports were 36,223,014, also *exceeding those of the*

United Kingdom in real value, being double the gross amount in 1824.

The French call their imports from Eng. land and colonies nearly 2¼ millions sterling, while we call it 1½ by our books.

France imports, of Cotton 350,000 bags, America uses 320,000, Switzerland 50,000, Prussia, &c. 150,000, together 870,000 bags, equal to that of the United Kingdom. Labour is ½*d.* less on every lb. in the U. S.

Official returns of 1839 make the value of the exports into Great Britain,—of silks, 13½ millions of francs; of brandy, liqueurs, and ratiates 14 millions; of wines, 5 millions, &c., or 1,300,000 sterling.

The French navy consists of 41 sail of the line, in commission or building, 62 frigates, existing or building, 31 corvettes, 49 brigs, and 21 steam-ships of war.

The French army consisted, in 1837, of 15,539 commissioned officers, of 75,835 non-commissioned, drummers, &c. and 210,734 privates. Total, 302,108.

There are 3699 kilometres (2312 miles) of canals; 34,511 (21,569 miles) of royal roads; and the departmental roads are 36,500 kilometres (22,800 miles).

France has finished, or is finishing, at the public expense, 1405 miles of inland navigation, at a cost of 10 millions sterling. The Nantes and Brest is 218 miles, with 1711 ft. of rise; the Rhone and Rhine, 203 with 1208; and the Berry, 186.

5 railroads are determined on in France; to Havre, &c.; to Lille, &c.; to Strasburgh, &c.; to Marseilles, &c.; to Bourdeaux, &c. Length, 3125 miles; cost, 36½ millions ster.

There are, in France, 33 insurance companies, 27 canal companies, 11 water companies, 20 mining companies, 20 packet companies, 23 bridge companies, 8 for railways, 34 for publishing journals, 21 for literary works, 6 for theatres, 34 for land conveyances, and 11 for gas-lights; besides 100 others for various objects, in thousands of shares at various amounts, and some at high premiums.

France is a country of great literary and scientific excitement; and this will be on the increase since the organization of their system of Universal Education. In mathematics, they are more profound than useful. In physics, they copy the crude English theories of the 17th century. In chemistry, botany, natural history, and geology, they lead all nations. In medicine, surgery, &c. they are unrivalled. In arts and manufactures, their taste is very conspicuous; but, in mechanics, they yield to England and America. In the art of war, they are pre-eminent; and, when not sold by traitors, or compromised by faction, victorious.

There were printed in France, in 1836, 5511 works, of which 1811 related to sciences and arts, 1588 belles lettres, 1314 history, 569 theology, and 229 law. There were, also, 229 in Latin and Foreign languages.

172,747 electors are registered in France, and of these about 130,000 have voted. The candidates elected have about 80,000 votes.

The Grand Museum of Versailles is unique, and highly interesting. It illustrates the history of France and of Frenchmen. It contains 2745 pictures of events, battles, and scenes connected with France, from Charlemagne to the present time; and 511 sculptures with the same object. There are 200 subjects on the reign of Louis XIV., and 100 historical pictures to illustrate the great actions of Napoleon, besides 10 portraits and 15 busts of him in marble. The whole is creditable to the genius of France, and honourable to the Government which formed the establishment.

In 1772, Buffon made the population of France 21⅓ millions; and, in 1840, it is 34.

The town population of France is taken at nearly one-fourth of the whole.

There are, in France, 47,000 primary schools, 36,000 for boys, and 11,000 for girls; and 2,170,000 attend in winter, and 1,300,000 in summer. There are 73 normal schools for instructing the teachers of the primary. There are, also, 873 boarding-schools, 322 communal colleges, with 27,000 scholars, and 41 royal colleges, with 16,000.

The revenues of the French minister of public instruction, are 527,152*l.*, for universities, colleges, and all public education. In England, Professor Jones makes the revenues of Oxford, Cambridge, and Dublin, only, 834,038*l.*; and, as is believed, much underrated. For other purposes of British education, at least a million and a half are paid.

The minister of public instruction, in France, having broken through the monkish regulation of teaching only Latin in colleges, and ordered that one living language, besides French, should be introduced, in the choice of the students, those in the Department of Paris decided between English and German, by 406 English to 165 German.

The Chamber of Peers, in France, is not hereditary, but mere creatures of the crown for life. A Deputy of the other Chamber must be 30, and pay 500 francs in direct taxes, and an elector 200. He is elected for 5 years, and it consists of 459 members.

19,345 are liable to be called on juries.

There are only 170,000 electors in France, and half these are placemen or place-expectants. The Chamber of Deputies is, therefore, a mere mockery.

In France, the poor have a share of the Octroi, or Town Customs; also, a share of all theatrical and exhibition receipts. There are no insulting and oppressive gaols, called workhouses, and no pass-carts. The clergy are very active in collecting, and honest in distribution.

The repeal of the cruel law of primogeniture has tended to promote the happiness of families, and to improve the soil. A single hectare supports a family, and farms of 9 or 10 are universal. At Havre, in 1834, the Editor saw, every day, waggons, full of rural kindred, entering to keep a fête.

There are 4,500,000 Poor in France, and 3 or 4 millions verging on poverty. But the charities are abundant, and administered at the dwellings of the Poor. There are no

bastiles, where poverty is treated as a crime.

In France, the commitments, in 1836, were 1 in 550 of the population; but 5 6ths were correctional only, or 45,000 out of 54,000 nearly. The criminal commitments were not half those in England and Wales.

The executions in the 3 last years, in England, were 85; and, in France, 80.

In France, the uneducated part of convicts is 89·4 per cent., the educated, 8·2 per cent., and the liberally-educated but 2·4; and, of these last, above half were for cases of only correctional punishment.

The population of Paris, exclusive of strangers, in 1838, was 909,126; the births, 28,942; deaths, 24,057; marriages, 8308.

Paris is three times its size than under Louis XIV.; it then covered 2739 acres, or 4·3 sq. miles; and now 8534 acres, or 13·3 sq. miles.

The Paris Exhibition of 1837 contained 2130 subjects, of which 1865 were paintings, by 895 male, and 166 female artists. In 1835, the number exhibited was 2536.

Paris has 16 principal theatres, affording sitting-room for 23,325 spectators. The French Opera, 1937; the late Italian, 1200; Theatre Français, 1522; Opera Comique, 1200; Odeon, 1628; Gymnasium, 1282; Vaudeville, 1257; Varieties, 1240; Port St. Martin, 1803; Gaité, 1800; Ambigu, 1900; Circus, 1800; &c &c. There are also 20 minor theatres, for about 12,000 spectators.

The following are the Distances, in English Miles, from Paris to the various Capitals of Europe, per Post-roads.

	Miles	
Amsterdam ..	325,	by Bruxelles & Antwerp.
Ditto	300,	by Ghent.
Augsbourg ..	835,	by Strasburg and Stutgard.
Berlin	688,	by Francfort and Leipzig.
Bruxelles	188,	by Valenciennes.
Ditto	214,	by Lille.
Constantinople	1280,	by Vienna and Belgrade.
Ditto	975,	by Milan and Laybach.
Copenhagen ..	820,	by Hamburg and Lubeck.
Dantzig	1005,	
Dresden	645,	by Leipsig.
Lisbon	610,	by Madrid and Badajoz.
London	288,	by Calais.
Ditto	290,	by Havre.
Ditto	275,	by Dieppe.
Ditto	280,	by Boulogne.
Madrid	318,	by Vittoria and Burgos.
Naples	1000,	by Rome.
Stockholm ..	1175,	by the Belts and Sound.
Petersburg ..	1240,	by Berlin and Konigsburg.
Rome	820,	by Genoa.
Warsaw	1070,	by Berlin & Posen.
Vienna	835,	by Strasburg & Munich.

In 1836, 305 new pieces were brought out at the Paris theatres. The receipts of the houses, within December, 1836, were 663,383 francs; of which the Italian Opera produced 104,000, and the French Opera 99,000.

The Average Expenditure of each Inhabitant in the City of Paris, in the Year 1826, was £40 8s., which makes a total of £35,388,774.—The following are some of the proportions for each Person.

	£	s.	d.
Rent	£3	12	0
Repairs of Houses ..	0	18	0
Corn	2	6	5
Flour	0	3	4
Maccaroni Grits, &c. ..	0	1	8
Meat of all kinds	3	2	0
Poultry and Game	0	8	4
Fish, (Fresh-water) ..	0	0	6½
Oysters and other Shell-fish ..	0	0	10
Fresh Sea-fish	0	4	0
Salted Sea-fish	0	2	0
Fresh and Salted Butter ..	0	8	8
Eggs	0	4	3½
Milk, Whey, Cream, and New Cheese	0	7	9
Vegetables and Fruit ..	0	12	5
Salt	0	1	7¾
Dry Cheese .. .	0	1	6¾
Olive Oil	0	1	7½
Vinegar	0	1	4
Brandy and Cordials ..	0	9	10
Wine	3	1	6
Cider and Perry	0	0	3
Barley, Beer, and Hops ..	0	4	10½
Sugar	0	19	9½
Coffee	0	7	11
Tea and Cocoa	0	0	9½
Spices, Honey, &c. ..	0	2	0
Water	0	3	9
Clothing	2	15	4
Fuel	1	18	3
Lighting	0	15	8
Washing	1	8	6
Furniture	2	13	10
Servants and Salaries ..	1	16	5
Horses	1	3	3
Carriages and Harness ..	0	2	6
Conveyances	0	9	1½
Tobacco and Snuff	0	5	1½
Baths	0	2	8½
Charities	0	9	0
Presents	0	1	6
Theatres and Exhibitions ..	0	5	7½
Lying-in Charges	0	0	9½
Nursings	0	2	11
Medical Aid	0	9	0
Newspapers, &c.	0	2	8½
Taxes	5	7	8

There are nearly 5 millions of mortgagees, who devour the proprietors by their 5*l.* to 10*l.* per cent. interest; but, in other respects, the subdivision is favourable to the happiness of the population.

Half the forests belong to individuals, and the rest to the crown and communes. The chief are in the Côte d'Or, Upper Marne, Vosges, and Meurthe.

The annual production is estimated at 6,000,000,000 of francs, or about 240 millions sterling at French prices, including 70 millions sterling for manufactures.

In 1835, France exported 76 millions of eggs to Great Britain, and 1 million to other countries. Paris consumes 101 millions.

The French colonists are half a million, besides Algiers 1½ million.

France imports a million of tons of coals.

The Budget of the Republic was 500 millions of francs, of Napoleon 1000, of Louis XVIII. 837, and of Louis Philippe 1000.

The Republic had 113 departments, Napoleon 130, the restored monarchy but 86.

Napoleon, in the 10 years of his reign, expended 1001 millions of francs on public works and improvements, 276 millions on roads, 30 on bridges, 48 on canals, 116 on harbours, 140 on fortifications, 32 on palaces and churches, 223 in charities and hospitals, and 134 in improving Paris, as 20 on the canal del'Ourcq, 11 on the museum, 11 on the Quais, 10 on the Louvre, and 10 on markets.

Pontarlier is the highest city in France, being 887 metres (2736 feet) above the sea level. Gex is 667 (2060 feet). The highest French mountains are the Arsines, in the Upper Alps, 4105 metres (13,400 feet), and Pelvoux, in the Isere, 3934 metres. Mont d'Or, in Auvergne, is 1886, and Cantal, in the Cevennes, 1935. Balon, in Vosges, 1429.

AMERICA.

Vague notions prevailed, but no general opinion, before the end of the 15th century, that the Earth was round; but in few cases do the most palpable truths force from men reasonings *à priori*. Afterwards, faith in the annual motion was for above a century a scholastic dogma, and, even to this day, no one but the present writer *has ventured* to apply the motions to the physical phenomena. The two motions so competent to produce the consolidation and weight of the parts, and the phenomena called *Time*, are ideas violently resisted; and the further inference, that the two-fold motions are also evidence of the motion of the solar system through space, are truths for another age, though a thousand times a thousand men live in their dreams, and eat and drink by speculations on these subjects. The execrable superstitions of Newton, like the extended plane of the terrestrial form, are defended even to the sword's point, and woe to him who for another century shall oppose them.

The improvements in navigation in the 15th century, the voyages on the African coast, the previous discovery and settlement of Madeira, the Azores, and Cape Verde Islands, rendered the discovery of the adjacent American continent a necessary consequence. The gulf stream brought trees, vegetables, dead animals, and even dead bodies of strange men to the Azores. On the 3d of August, 1492, Columbus sailed with three small vessels, appointed by the Court of Spain, destined as all believed for the East Indies; but, on the 12th of October, he fell in with St. Salvador, or Cat Island, one of the Bahamas, proceeded through the Gulf to Hispaniola, and then returned to the Tagus, March 4, 1493, after seven months absence. He subsequently made three other voyages, and after suffering various indignities and wrongs from the Court of Spain, died, aged 60, in 1506. The Spaniards called him Colon, the French Colomb, the Italians Columbo; and there are those who detract from his merit, just as envy always robs originality and perseverance of its reward, of which Fulton, Winsor, Lancaster, &c. are modern instances.

Pinçon, an officer of Columbus, discovered Brazil, in 1499, and its first colony was formed in 1531. It is now nearly two millions of square miles, with a population of nearly five millions.

The continent of AMERICA extends from 75° north to 55° south latitude, or about 8000 miles in length; and in its broadest part has 40° of longitude, or 2000 miles. In the Mexican isthmus it varies from 100 to 200 miles.

The island in the Banamas, which Columbus first discovered, in 1492, was Guanahani; he called it St. Salvadore, and the English, Cat Island.

The first known discovery of America was by Martin Behem. In a first voyage of discovery, in 1460, he found an island covered with beech-trees, which he therefore called *Fayal;* and others abounding in hawks, which he therefore called *Azores.* He afterwards visited Brazil, and sailed as far as the Straits of Magellan, in 1484. The voyage of Columbus was in 1492. Moreri, however, maintains, that America was known to the Egyptians, Phœnicians, and Carthaginians, and it seems probable.

NORTH AMERICA is divided into the British Possessions of the two Canadas and Nova Scotia, and the United States.

MIDDLE AMERICA, into the Republics of Mexico and Guatimala.

SOUTH AMERICA into the Republics of Columbia, Peru, Bolivia, Chili, and Argentaria.

The Empire of Brazil, the British Colony of Demerara, the Dutch of Surinam, and the French of Guinea.

The WEST INDIES among the British, Spanish, French, and Dutch nations, in their respective islands.

South America, even above North America, transcends in all natural productions for purposes of general commerce, and is super-abundantly provided with water intercourse for their transmission. But these matchless countries have, to this age, been paralyzed by the imbecility of the Spanish character, by the gross ignorance of the remaining population, and the worse than beastly superstitions of a lazy and pampered priesthood.

America contains the highest mountains, and the largest rivers in the world, with every variety of climate; and its governments being, for the most part, free and liberal, the whole is rising on the decay and exhaustion of the old continent.

The breadth of the North American continent, from Long Island to Vancouver's

Island, is 50° of 52 miles, or 2600 miles; and length of the United States is about 15°, or 1000 miles.

The distance from Cape Clear in Ireland to New York is about 3000 miles. The distance from the western coast to China is about 5000 miles.

The breadth of the South American continent, from Salvador to Lima, is about 45° of 60 miles, or 2700 miles.

The climate of the United States includes from the tropic of Cancer to lat. 50, but it is colder and hotter than the old continent in the same latitudes; the differences being 9° in the lat. of Philadelphia, and 12° in that of Boston; while snow lies on the ground from three to five months, between lat. 40 and 50, and the summer heats are from 80 to 100. In some places it is often 22 below Zero in winter, and 105 in summer.

There have been 12 Presidents of four years in the United States. The salary is 25,000 dollars. The four Secretaries of State have 6000 dollars.

The President of the United States, the Vice-president, and the six members of the Cabinet, receive in all, 64,000 dollars, or 12,850*l.* sterling.

The American Senate consists of two, chosen by the 26 legislatures of the several States, and has the Vice-president of the Union for its President, with a salary of 5000 dollars, about 1200*l.*; and, during Sittings, other 16 dollars.

The House of Representatives consists of 242 members, each chosen by 47,700 population. They receive 8 dollars per day during the Sittings, and 8 for every 20 miles of travel from their State. The Speaker has 16 dollars per day.

In the United States, every member of the 244 of the House of Representatives is chosen by an even population of 47,700 every 2 years. The Upper House of 52 senators is chosen 2 for each state every 6 years, and a third go out biennially. The persons elected to choose a President and Vice-president for 4 years from March 4, are 294, and they are chosen by the people in districts, by general tickets, or by the state-legislatures. The President of the Senate is the Vice-president of the United States. New York returns 40 representatives, Pennsylvania 28, Virginia 21, Ohio 19, and Michegan and Arkansas but 1 each, as per 47,700 population.

The Chief Justice of the United States has 5000 dollars, and the 3 other judges 4500, that is, about 1200*l.* or 1100*l.* per annum.

The Seven Ministers Plenipotentiary have 9000 dollars per annum, the Secretaries 2000, and the *Chargés d'Affaires* 4500.

The Governors of each State, chosen by the people, have from 1200 to 3500 dollars salary each.

In 1829, the whole body of the Statute and Common Law was revised, re-written, and published. Every male is an elector, who has resided twelve months in the State, or six months in his county, and the number of electors was 296,583, and representatives 42.

New York is in lat. 40° 40', and Rome in 41° 54'; yet the average of the thermometer for the year is, at New York, 53·8, and at Rome 60·4; while, in the three winter months, the thermometer averages at New York 29·8, and at Rome 45·8; and, in the three summer months at New York, it is 79·2, and at Rome 75·2.

North America has 119 native quadrupeds, and Mexico and South America many others. 21 are nearly of the same species as on the Old Continent. European quadrupeds, transplanted to America, have changed many of their primitive characters. The hog is a wild boar. The cow gives milk only for the calf. The wild horse becomes a uniform chesnut. Sheep cast their superfluous wool in mass, and goat's hair takes its place. The goat reserves its milk like the cow.

American Population in 1820 *and* 1830

	1820.	1830.
Eastern States	1,659,854	1,954,682
Middle ditto	3,179,944	4,108,959
Southern ditto	2,547,726	3,022,812
Western ditto	1,414,729	2,253,103
South-western ditto..	779,569	1,367,471
Territories..........	56,181	136,611
	9,637,299	12,976,649

The following was the population of some of the principal places in the United States, according to the last census:—New York, 213,107; Philadelphia, 161,412; Baltimore, 80,519; Boston and Charleston, 70,164: New Orleans, 48,674; Charleston, S. C. 30,289; Cincinnati and suburbs, 26,513; Albany, 24,516; Washington city, D. C., 18,823; Providence, R. I., 17,832; Pittsburgh, 17,313; Richmond, Vir. 16,085.

The increase of population in the United States is not 8 per cent. in 10 years in the old states; but in new tracts, as Indiana, Michigan, &c. it is 200 per cent. In Connecticut, in 1790, the number was 237,946, and, in 1830, it was but 297,711. Delaware, in 1790, was 59,096, and, in 1830, was 76,739, though there have been great immigrations. Both the free and the slave population have trebled since 1790, in the whole.

In 1790, the white population was 3,164,148. In 1800, it was 4,312,841. In 1810, 5,862,092; and, in 1820, 7,861,710. In 1836, about 13,000,000. The immigrations are estimated about 20,000 a year, which, in 30 years, would be 600,000: besides, the States have been increased, by the Mississippi, Floridas, &c. to the number of 1,000,000.

In 1837, the gross population of the 28 United States was 12,689,856 whites, 237,864 free-coloured, and 2,791,588 slaves.—Total 15,719,308. In 1830, the whites increased 2·95 per cent., the slaves 2·67, and the whole 2·913.

The Mayor of New York lately stated officially, that, owing to tyranny and op-

pression in Europe, the arrivals in 1837 had exceeded 2000 per week, most of whom wander, without money, friends, or employment. "The alms-houses and asylums," he says, "can receive no more, while the increase is such, that he calculates they will soon be 3000 per week." What a picture of the effects of our atrocious Poor Laws! Of the last 81,000, there were 4,800 from the United Kingdom, 2781 from Canada, &c., 20,141 from Germany, 4500 from France, 568 from Prussia, 445 from Switzerland, &c.

The Aborigines of North America and Mexico are not quite two millions; and of these only the Choctaws, Cherokees, Creeks, and two or three small tribes, have made such advances in civilization, as lead them to build and cultivate. M'Coy considers that 10,000 as educated, and says, that other 60,000 perform mechanic arts and manufacture. Guess, a Cherokee, has reduced their language to the written form. The American Government have lately assigned to the tribes a territory of 600 miles by 200, west of the Mississippi; fixed the bounds of each, and afforded all the means of promoting their civilization and independence.

New York City, in 1830, contained 223,009 inhabitants, and Albany 25,238.

The Cherokees now possess negro slaves, and live by agriculture.—*James.*

The American character is that of the persons who have their living to get, or who, by habit, continue to accumulate through life. Hence, the improvement of manners and mind is a secondary object, and every one follows his own humour without any idea of deference to another. Mathematics, the sciences, and critical researches do not interest one in a million.—*Trollope.*

The Araucanian Indian nation is one of the finest native races in South America.

The Pennsylvania, or United States Bank, has a paid-up capital of 35 million dollars. Their circulation is 10 million dollars, and the loans and discounts are 57 millions.

Dr. Kelly, in 1825, estimated the republic of Mexico at 6,868,000 inhabitants; Guatimala at 1,485,000; Columbia 3,600,000; Peru 1,900,000; Chili 1,200,000; La Plata 1,500,000: all on rapid increase to 1840.

The population of Mexico is about eight millions, to a territory of 1,500,000 sq. miles.

Central America is in six States, containing about two millions. But the government was unsettled in 1838. Guatimala, the capital, has about 50,000 inhabitants.

Four-fifths of the population are engaged in agriculture, and the other fifth in manufactures and commerce. The unproductive classes are one-fifth more. The Indian population is about 120,000, and the other Indians around are 180,000

During 1833, there were 10,000 criminals in prison, in the United States, and 1000 debtors. Also 1000 lunatics. The criminal commitments, in 1833, were 75,000, and the debtors 38,240.

The various settlers in the United States have, in the first and second generations, been more intent in laying the foundations of prosperity than in enjoying it. They, however, closely imitate Europe, and its pursuits. In the mechanic arts they have no rivals, and already teach other nations. In ship-building, trade, canals, railways, and roads, they have deserved fame. In cheap government and institutions of liberty, they are a model to all nations. In literary composition they are on a par with every nation, but in physics and experimental science they are copyists of the olden authorities.

The American Army consists of 648 commissioned officers, and 7310 non-commissioned and privates. The militia are 1,333,091.

The Navy consists of 11 sail of the Line, 17 frigates, and 28 sloops and schooners.

They reckon 1,341,547 militia-men in the United States.—The clergy at 10,405, and the children in the public schools at 1,065,147. The salaries of the clergy are 2,652,260 dollars.

The army, in 1837, was 7958, including 2 regiments of dragoons, 4 of artillery, and 7 of infantry, with 4 generals, 15 colonels, &c., and 5625 privates. The number of the trained militia is 1,326,821.

All travellers infer a similarity between the American natives and the Tartars, in manners, opinions, and language. They have like superstitions, and say they were driven away by the rising of the waters. All the tribes dwindle in numbers, from various diseases and bad practices.

The American Indians, for the most part, take upon them the name of some animal; as the blue snake, the little turkey, the big bear, &c.; and their signatures to conveyance deeds of land, &c. consist of the outline, drawn with a pen, of the animals whose names they bear. An Indian calumet of peace is a long pipe adorned with feathers. Belts of wampum consist of shells, black and white, in the form of beads strung upon a thong. By them they recollect events, and they serve instead of writing, being variously construed for different purposes.

As the United States extend from lat. 45 to 25, so various states produce the growth of all climates, from the corn, wool, and hemp, of the north, to the cotton, rice, sugar, coffee, and indigo, of the south, while middle states raise tobacco.

America is calculated to contain half the useful soil of the old continent, or about 10 millions of square miles, each capable of supporting 350 persons, or four times the present population of the earth. The entire population is 35 or 40 millions.

In the United States, 90 million lbs. of cotton are produced in Alabama, 80 in Georgia, 70 in South Carolina, 160 in Mississippi, &c.

Cotton yields from 250 to 300 pounds to the acre, and occupies in the United States about 1,750,000 acres. It employs nearly 700,000 hands and assistants. The capital engaged is 800 millions of dollars. In 1790, the produce was but 1 million pounds, and, in 1815, but 100 millions of pounds.

The American prices, from 1831 to 1836, averaged $12\frac{1}{2}$ cents, and, in England, they averaged $8\frac{3}{4}d.$, or $17\frac{1}{2}$ cents.

In 1793, the United States exported but 1 million pounds of cotton; but, in 1836, 400 millions. In 1834, Egypt, &c. exported 23, Brazil 30, India 80.

The exports of Sea Island cotton, worth 2¼; the other kinds were, in 1834, 8 million pounds, chiefly from Georgia and South Carolina.

In 1832, the American cotton manufacture had doubled in four years, and stout American fabrics are on sale in shops in London.

The Northern United States, in 1837, manufactured 200 million yards of plain calicoes; and, also, 5½ millions sterling worth of woollen goods.

The United States produce above 500 million pounds of cotton, which employs a million of hands. Nearly 4-5ths are exported in the raw state.

The value of manufactured cotton goods is estimated on American authority, in 1835, in England at 160 millions of dollars, at 4·8 to the pound sterling; in France at 62; and in the United States at 48. The capital in England was about 200 millions of dollars, 120 in France, and 80 in the United States.

In 1836, the United States exported 7⅝ million pounds of Sea Island cotton, and 380 millions of other kinds, value 65 millions of dollars. Of these quantities, the United Kingdom received 6⅝ and 263 million pounds, value 45 million dollars, and France 1 million and 87 millions.

The gin for cleaning cotton was invented in the United States, by Whitney, in 1792, and is a master-piece of ingenuity. Till its invention, a woman could separate the seed from only 1 lb. of cotton per day, but by this machine one man can separate 2 or 300 lbs.

37½ millions of acres of land (equal to England and Wales,) were sold by the American government in 1835-6-7, being more than the whole since the Union; and 3-4ths were bought on speculation, since 3 millions per annum suffice for new cultivation and immigration.

The public lands of the United States exceed 1000 millions of acres.

167 millions of acres were surveyed and offered before Sept. 1835, and only 44½ sold. Any family may, therefore, become proprietor of 360 acres of the best land, in the best climate in the world, for 100*l.*, at the Public Land Office in Philadelphia, &c.

The sale of lands, at 1¼ dollar per acre, was, in 1834, 4½ millions of acres; in 1835, 12½; and, in 1836, 22 millions. It was this increased speculation in land, which led, in 1837, to the derangement of the monetary system. The speculation was chiefly in the new states of Indiana, Illinois, Mississippi, and Michigan.

The imports of the United States, in the year ending Sept. 30, 1837, were 141 millions of dollars, at 30 millions sterling; and the exports, 117½ millions dollars, about 25 millions dollars. 1-6th in foreign vessels.

The exports were sundry products, 17⅝ millions Tobacco, 5·8 millions; cotton, 63½ (above half the whole); manufactures, 3 millions; cotton-pine goods, 2·83 millions; other articles, 2·2 millions of dollars. Great Britain received 54·6; France, 19·7; Netherlands, 3½; British North American colonies, 3·29 millions.

The imports were 44⅝ from Great Britain; France, 22; Cuba, 12½; China, 9; Mexico, 5·65; Brazil, 5; Hanse Towns, 5·64; British East and West Indies, 4½; British North American colonies, 32·6 millions dollars.

The value of the imports were 10½ millions dollars in bullion and specie; 8·65 coffee; 3·3 skins; tea, 6; and 36 millions of silk, linen, worsted, and cotton goods; 3 silks from China; 5½ iron and steel goods; copper, brass, tin, &c. goods, 1½; earthenware, 2½; wines, 4; sugar, 7·1; cigars, 1·2; iron, steel, and heavy articles, 4·6; wheat, &c. 4½. Total, 140,989,217 dollars' worth.

From 1772 to 1775, North America exported about 100,000 lbs. of tobacco per annum, of which 3-8ths were consumed in the United Kingdom, and 5-8ths in Europe. From 1787 to 1789, it was 89 millions lbs. The average, from 1815 to 1835, was 99½ millions lbs., in hhds. of 1200 lbs. each, at 7½*d.* per lb., in 1835, or total value 8½ millions dollars; or 10 as prepared in snuff, &c. In 1820, France grew 33 millions of lbs. In 1832, the United Kingdom took 36,000 hhds.; but, in 1835, only 28. The Hanse Towns, also, took 28. France, 6½. Holland, 18. Sweden, 2⅝. Gibraltar, 2½. The home consumption, in the United States, is 100 millions lbs., chiefly in cigars; and New York expends 3½ millions dollars for bread and for tobacco.—*American Almanac.*

In the United States, in 40 years, flour has varied from 14 to 5 dollars, and averaged 8·51; rice has averaged 4·61 per cwt.; cotton, Upland, from 33 to 10, average 20½ per lb.; tobacco has averaged 8·07 per cwt.; coffee, 22 per lb.; and sugar, 12·03 per cwt.

766 new vessels, and 124 new steam-boats, were built in the United States, in 1836; total, 113,627 tons. The tonnage of the principal places was 1,370,000 tons. A new steam-vessel is launched per day.

The American trading-vessels entered inwards, in 1835, were 7023, of 1,359,653 tons; and the foreign were 4269, of 641,310 tons. 528 American, and 480 foreign, at New York, which port imported 88,191,305, and exported 30½. Louisiana imported 17½, and exported 36½. The foreign ships were 3682 British, 162 Spanish, 123 Mexican, 95 Hanseatic, 65 French, 64 Swedish, 18 Danish, and 17 Dutch.

The mercantile shipping is about 2 millions of tons, every 200 tons having 9 men. The foreign trade employs 700,000 tons, and the coasting 920,000; the rest are in fishermen, and 150,000 in steam. The American seamen are 85,799, with 8000 masters, mates, &c. About 30,000 are naturalized British seamen.

The entries from foreign ports, in the United States, in 1836, were:—American, 1,255,834 tons; British, 547,606; other nations, 132,607; total, nearly 2 millions.

The imports and exports of the United States:—

1810	£17,791,666	£13,907,909
1830	21,477,602	15,385,314
1836	39,579,174	26,804,799

The tonnage of the United Kingdom increased from 2,167,863 in 1803, to 2,792,646 in 1836.

The British trade with America, United States, is 41·76 per cent. of their trade; and the American trade with Britain is 22·31 per cent. of the whole British trade.

Virginia exports about 45,000 hhds. of tobacco, and above half a million of barrels of flour. To aid this and other produce, there are half a million of black slaves.

The domestic use of tobacco in the United States, is estimated at 100 millions of lbs. per annum, at the value of 10*d.* per lb. Of cigars, only 200,000 dollars worth are smoked per annum, in New York only. The whole consumption in the United States, taken at 10 million dollars worth, is 8 times more than in France, and 3 times more than in England, man for man; and equal in value to the consumption of bread. Nor are the United States so bad as the Havannas, nor worse than Holland and Germany, where two men out of three are constant smokers!

New York is the great emporium of the commerce of the Western world. It contains nearly 250,000 inhabitants, and is superbly built on the finest harbour in the world. It imports half the amount of those into the whole United States, and exports a third. Its harbour always presents a forest of 800 ships at anchor, and about 1600 foreign voyagers, and 4000 coasting-ones proceed from its port every year.

The sugar-cane succeeds in Louisiana, and yields above half the sugar used in the Union; an acre producing 9 or 10 cwt. Rice is also a productive crop, an acre, in moist situations, yielding 10 or 12 cwt. Indian corn yields from 40 to 100 bushels per acre, and wheat from 22 to 50. Tobacco about 1400 cwt., and cotton, when prepared for the market, from 1¼ to 2 cwt.

Provisions are cheaper in the United States than in Europe, but all articles of dress and taste are much dearer.

South America, like Asia and Africa, has its companies or caravans of itinerant traders, called *Callavayas*, who deal in drugs, and practice as physicians, in journeys which last for years.

Tepic, in New Galicia, 40 miles inland from the fine port of San Blas, is the chief seat of Mexican commerce on the Pacific, and a flourishing city.

To exclude foreigners from Paraguay, a port on the Paraguay, nearer than Assumption, has been adopted for commercial intercourse, called *Neembucu*: and it happens that this place is very near the junction of the Peruvian and Pacific river Vermigo, with the Paraguay. This voyage was performed by Soria, in July, 1823, and, as an inland communication of the La Plata with the Pacific, will prove very important, as soon as the Creole Spaniards have proved themselves fit for social life; for Spanish America is greatly below the average of civilization.

The late escape from Paraguay of the Robertsons, from the lawyer-like tyranny of the monster Francia, has, however, enabled them to bring us acquainted with the Yerba or Paraguay Tea, the Lapacho-tree with timber larger and superior to the oak, and with 50 other products, as surprising as useful, hitherto shut out from the world by Spanish policy, and by the necessary navigation of 3 rivers 1500 miles, with a slight current, which, however, will yield to steam navigation when applied to them.

Pittsburgh, in Western Pennsylvania, on the point where the Monangahela and Alleghany rivers join, contains about 30,000 inhabitants; and, being in the centre of a vast coal and iron district, is the seat of many manufactories. It has nail and rolling-mills, 12 foundries, where 3000 tons are cast, 37 steam-engines, 8 cotton-factories, 8 paper-mills, 13 brass and copper-works, &c. &c. trifling, when compared with the Birmingham and Sheffield regions, but growing.

The manufactures of the state of Massachusetts employ 97,226 hands, valued at 83½ millions of dollars. Boots and shoes employ 39,068; clothing, &c. 3939; cotton cloths, 19,754; calico-printing, 1660; iron, 1311; leather, 1798; machines, 1399; nails, &c. 1095; paper, 1173; stone, 1177; ship-building, 2834; woollen fabrics, 7097. The population of Massachusetts is 1-20th of the United States.

The United States have 20 millions of sheep, which yield annually 50 millions lbs. of wool, worth 20 millions of dollars.

For woollen manufactures, there are 1549 sets of machinery, 344 of which are for broad-cloth, and 61 for carpets.

The Americans calculate that 500 manufacturing families consume as many custom-house goods as 2000 agriculturalists. They also determine that 12 millions of people consume 249 millions of dollars of food, 202 millions dollars of clothing, &c. &c.; in all, 1066 millions-worth of all produce.

An official document states the particulars of the cotton manufactory in the United States, in 1832, about a third of 1840; and we have official information, on nearly the same points, as to the United Kingdom.

The United States has 795 factories, and we have 1070.

They consume 77 million lbs. of cotton, we about 310, or 1 to 4. Their factories are, therefore, to ours, as 1 to 3 in efficiency.

They employ 18,479 males, besides weavers and children under 13; we 67,500; 38,827 females, we 70,100; 4961 children under 13, we 28,574.

They employ 4760 power-loom weavers, and we 54,000 hand and power-loom.

The whole of their wages, in 1832, was 2,087,400*l.*, that is, 12*s.* per week on the average of hands; and our wages at 10*s.* 5*d.* per week on the average of ages and employments, making, on 225,000 hands, 10,725,000*l.*

The yards of cloth, made by the United States, were 230,461,900, value, 5,350,000*l*., at 6*d*. per yard; which, in ratio of our cotton consumed in cloth, independently of twist, ought to give us 7,201,385,700 yards. We export 70 millions as twist, or, with waste, one-third; but, taking our fabrics in weight, to theirs as 2 to 3, which appears by our excess of weavers, our quantity may be 1080 millions of yards nearly, of which about half, or 540 or 550 millions, are exported, and the other half for home-consumption.

The valley of the Mississippi is 1400 miles from N. to S., and 1470 from E. to W., between lat. 29° and 49°. Two-thirds are arable land, containing 14 times the quantity of land capable of cultivation in the British Islands. Its present population is under 6 millions; while, in 1790, it was only a quarter of a million; and, in 1820, but 2½ millions. With the highest known rate of population, it might support in abundance 200 millions; but there must be no peers or princes, and no overgrown occupiers or proprietors. It consists of two slopes to the two great rivers, and every part is navigated by steam-boats. South of the Ohio mouth is the lower valley, and North the upper, and they are distinguished by their climate and products. In one there is no ice in winter, and the products are cotton, sugar, tobacco, and indigo. In the other, there are sharp frosts, and the products are grain, stock, hemp, and minerals. The Missouri is deemed the main trunk, but the Mississippi and its branches are the most useful to man. Both run 3000 miles.

The extensive prairies in the great valley remain so, because trees will not grow on a thick grassy sward.

A desert, of several hundred miles wide, divides the fertile lands of the Mississippi and Missouri from the rocky mountains and the Pacific.—*Peck.*

All mercantile communication from Europe to the Great Valley is *via* New Orleans, whence packages pass by water to every part. Emigrants, without heavy luggage, go by New York or Philadelphia. The distances are immense. It is 394 miles from Philadelphia to Pittsburgh, 466 thence to Cincinnati, and 509 from this to the Ohio mouth; then 850 to St. Louis. The cost of the whole about 50 dollars, and the time 15 or 16 days.

The valley of the Ohio, 750 miles by 261, is the favourite resort of European settlers, and it produces every thing desirable to man in an abundance without example. The mean summer and winter heat of Cincinnati, the capital, is 34° and 74½; and the clear days average 172°, the rainy being about 60°. Any settler may purchase 40 acres of rich land for 50 dollars, and at this price there is always plenty on sale. The country is divided into sections of square miles of 640 acres; then into ranges E. and W., and into townships taken N. and S. There are 5 meridian lines, and 5 bases to count the sections from. The usual lots are 8ths, or 80 acres at 1¼ dollar each, in general, with 5 years' exemption from taxes. Emigrants should apply to the Government Land Offices, and beware of speculators and jobbers.

The province of NEW YORK presents an extraordinary spectacle of rising prosperity. It is 400 miles long, and 300 broad, containing 45,658 square miles, or 29 millions of acres; of which, 8½ are in cultivation. It contains five cities, (New York, Albany, Troy, Hudson, and Schenectady,) 764 towns, and 108 villages.

It lies between lat. 40° 30′ and 45°, and its mean temperature, for five years, was 48°; its rain and snow was 38·22 inches; and its extreme temperature 104 F., and 33 below Zero.

It contains 2284 grist-mills, 6340 saw-mills, 121 oil-mills, 1231 fulling-mills, 1685 carding-mills, 131 cotton-factories, 223 woollen-factories, 191 iron-smelting works, 184 trip-hammers, 2206 asheries and salt-works, which, in 1836, made 1,600,000 bushels.

The State has constructed the *Mohawk and Hudson Rail-road*, 15 miles. The *Ithaca* and *Oswego Rail-road*, and the *Saratoga Rail-road*.

It supports four colleges, and two medical colleges; 77 incorporated academies, and 9662 common schools, educating 597,503 children between 5 and 16, and not in the badge of charity-clothes.

There are 1482 religious congregations, each of which pays its own teachers; and four theological seminaries.

The finances in 1836 were, receipts 2 million dollars; of which, 1,520,939 were applied to canals, 138,920 to schools, and 3860 to literary objects.

The poor, on two millions of inhabitants, cost 250,000 dollars; the paupers being 6000.

The value of real and personal estates in 1836 was—real, 300 millions of dollars; personal, 75 millions.

The countries watered by the Mississippi, and comprehended in the United States, are 1400 miles long and 1200 broad, comprehending an area of 1½ million of square miles, or more than three times as much as the 13 ancient states.

The Alleganies cover a tract of 1100 miles long and 120 broad, being from 1000 to 6000 feet high. The land near them consists of their substance. The tract near the sea, 20 or 50 miles wide, is a sandy encroachment on the sea, brought down by the rivers Connecticut, Hudson, Delaware, Susquehannah, Potowmac, and six or seven others, which run from the mountains to the sea, from 200 to 350 miles. The drain on the other side of the mountains is the Mississippi and its branches.

The river Ohio, which gives name to a state in America, runs into the Mississippi, and is navigable for numerous steam-vessels. The present population of the state is a million, and it extends over 40,000 square miles, between 39° and 42° of N. latitude. Columbus and Cincinnati are its largest towns. The Ohio is nearly 1200 miles before its junction with the Mississippi, and nearly one-third of a mile broad.

The state of Missouri contains 38 millions of acres: and the undivided territory, besides, is 900 miles by 800, four times the size of France. It is in the latitude of Southern Italy, yet the winters are very severe, and the Missouri frozen over. The open prairies extend hundreds of miles, and every mineral and vegetable product exists in superabundance. St. Louis is the capital, and contains 10,000 inhabitants, a college, and public library. There are roads as far as the Pacific.

The Illinois country, lying between the Ohio, Mississippi, and Illinois, intersected by the Wabash, and approximating Lake Michigan, is considered in America as the most promising district, in position, in fine soil, abundant coals, iron, lead, &c. It is in the fine latitude 36°—40°, and connected with vast tracts by the Missouri.

The Saratoga Springs is the fashionable Spa of the United States.

Washington is in latitude 38° 52′ 54″, and longitude 77° 1′ 48″. New York 40° 42′ 40″ latitude, 74° 1′ 8″ longitude.

In recent observations on the Andes, by Pentland, he asserts, that Nevado de Sorato is the highest of them, being 800 feet higher than Chimborazo, or 25,000 feet; and he considers Illimani near Paz, in Bolivia, as equal to Chimborazo, or 24,200 feet.

The Gulf of Mexico, the drainage of North America by the Mississippi, may be regarded as the lake or debouche of that great stream.

The Isthmus of Panama, about 70 miles wide and 350 long, is considered as the boundary of North and South America.

Russia, not content with its vast Asiatic territories, has seized on, and claimed a large tract of territory on the eastern side of Behring's Straits. It extends over 25° of lon. and 10° of latitude, and includes the northern discoveries of Cook. The Aleutian islands, part of Russia, stretch from America to Asia, like the piers of a bridge.

The Republic of Mexico is 1800 miles by 900, and large portions of it are 6 or 7000 feet above the sea. Its produce is all the articles of the tropics and the temperate zone, and it is a most promising country. The population is 7 or 8 millions. Mexican history goes back 1200 years, and is mixed with some early traditions of the Deluge.

Chuquisaca, the capital of Bolivia, (late La Plata) is 9300 feet above the sea, in the silver district, and contains 20,000 inhabitants.

Rio Janeiro is the last mart for slaves. In 1832, 20,000 were sold there! In other respects, Rio Janeiro and its vicinity are to be admired, as the most fertile and enchanting spot in the world.

Behring's Straits are from 40 to 50 miles wide, and between lat. 65 and 66. Navigation is obstructed by the ice two or three degrees to the north of them, the Asiatic coast bending westward, and the American eastward. Kotzebue's Sound is in lat. 66° 12′ 30″, and long. 164° 12′ 50″; and he found mammoths' bones in the vicinity.

The north-east cape of North America is in 69° 41′ N. lat. and 82° 35′ W. lon. Cook explored the north-west coast, to lat. 70. The Esquimaux appear to inhabit the entire coast of the North American Ocean, from Greenland to the south of Behring's Strait, with uniformity of language and manners.

New Granada includes Panama, Carthagena, Bogota, &c., with 1½ million of inhabitants.

Venezuela includes Caraccus, Cumana, &c., with 1 million.

Equator includes Quito, Guayaquil, &c. with ¾ million.

Peru includes Lima, Cusco, Truxillo, Arequipa, &c., with 1½ million.

Bolivia includes Potosi, Chuquisaca, La Paz, &c., with 1¼ million.

Chili includes Valdivia, Santiago, Coquimbo, &c. 1½ million.

Argentine includes Buenos Ayres, Tucuman, &c., 1½ million.

Uraguay includes Monte Video, &c., and 150,000 inhabitants.

Paraguay includes Assumption, &c. and ½ a million inhabitants.

Brazil is an empire under Pedro II., born 1825, and includes Rio Janeiro, Pernambuco, Para, Bahia, &c. with 3000 square miles, and 5 or 6 millions inhabitants.

The nineteen provinces of Brazil contain but five and a half millions of inhabitants, of whom two are slaves. Brazil is 2300 miles long, and 1100 broad, in a fine climate, with a luxurious soil, and connected by the Parana and various rivers; besides enjoying the advantage of a line of coast equal to its length, with many fine harbours. Its luxuriance is such, that its extensive woods, often for a thousand square miles covered with the largest trees, are absolutely impenetrable, except to the birds who abound in their branches, and to innumerable crawling creatures, who live on their fruit and bark. The native population is very trifling, but they are well-made, active, and very wild. The Portuguese, who live on the coast, have the lowest moral qualities, and are the abject slaves of an ignorant priesthood.

Columbia extends, on the Atlantic, from Cape Nassau to Cape Gracias and Dios; and, on the Pacific, from Golfo Dolce to the Tumbes. It meets Peru and Brazil at the Yaberi and Maranom. The population is above 3 millions, of which half are whites.

Owing to the increase of the horse in the Pampas, the Indians south of the Amazons have become equestrian, like the Tartars.

Newfoundland was discovered by John Cabot, a Venetian, on the 24th of June, 1497, in a squadron of discovery which sailed from Bristol.

The table-land of Mexico is healthy, but unfruitful, while the coasts are unhealthy, but adapted to produce more than all the world could consume. The only anchorage, however, on the east, is Vera Cruz, a seat of pestilence, and the gulf being a marine *cul de sac*, receives, as a dam, the whole force of the Atlantic. On the west, there are two ports, San Blas, and Acapulco. Mex-

ico contains 200,000 inhabitants in a highly-picturesque district, and fine climate. The population of Mexico and New Spain is now nearly 8 millions, of all mixtures of colour, covering 1 million of square miles. In wheat, the increase is 50 and 80 to 1, and in maize 200 to 1.

Bolivia lies between the Paraguay and the Pacific, and includes the silver mine districts of Potosi, La Paz, &c. It is central, being bounded on the east by Brazil, on the north by Brazil and Peru, on the west by Peru and the Pacific, and on the south by Chili and Argentia. Its port is Cobija, mid-way between Lima and Valparaiso. It includes two ridges of the Andes, and some fertile regions adjoining Brazil. The capital is Chuquisaca, near Potosi. The total population is not 2 millions, or 2 to a square mile.

Columbia, in 1834, was divided into three Republics, New Granada, Venezuela, and the Equator.

The Rio de la Plata, an arm of the sea, which receives three great rivers, the Paraguay, the Parana, and the Uraguay, is 150 miles broad at its mouth, and is an opening and drain to vast plains, which extend on every side to the Andes. On its south side stands the city of Buenos Ayres, celebrated for its extent and regularity, and the seat of a republican government, which asserts its ascendancy over immense tracts of country. The thermometer varies from 100° to 45°, and every degree of climate is experienced according to elevation. Prodigious numbers of settlers from Europe go to these fine provinces; and, if the government is just and wise, they will rival North America, the climate being finer, the soil richer, and the productions as abundant as various. The extent is about a million of square miles, or fifty times larger than Great Britain. In the Pampas of Buenos Ayres, twelve millions of cows, and three millions of horses are property, besides the wild herds.

Texas is four times the extent of Virginia, with a constitution like that of the United States. Its first President was General Houston, and the seat of government is called Houston. The population is 100,000.

Bogota, the capital of Columbia, is on an extensive plain, 8694 feet above the level of the sea, in the most delightful temperature and healthful atmosphere. The Magdalena is its communicator to Carthagena, by steam-vessels, and by the Negro to the Orinoco.

The republic of Chili lies between the 24th and 36th deg. of south lat. in the best climate of the temperate zone, and includes the fertile level tract, 300 miles wide, which lies between the Pacific Ocean on the west, and the Andes on the east. In these mountains, there are fourteen recent volcanoes, and some of them commonly burning; hence the country is subject to earthquakes, and the houses are built low. The productions of every climate arrive at perfection in it. Marine substances are found every where, even on the tops of its secondary mountains. Gold is very abundant, and there are many valuable mines, besides the quantities found in the beds of rivers. Silver, copper, and iron are also very abundant, as well as pit-coal. Many of its trees are of gigantic size, particularly the red cedar, and there are few or no noxious animals.

The boundary of the republic of Peru is the river Tumbez, in latitude 23° 26′ south, and it is separated from the Chilian territory by the Loa, in latitude 15°.

The south of Chili is highly fertile, the north as sterile as Arabia, and without rain.

The Indian antiquities are few and trifling. Axes and knives of stone, potters' ware, rude ornaments of copper and silver, with the calumet or large stone-pipe, spear-heads, &c., are found in their burying-places. Skeletons and mummies are also found in the nitrous caves of Kentucky, and a few earth-works for camps.

Peck denies the existence of ancient races in the Great Valley, and asserts, that there is not a skeleton to be found, except in caves, more ancient than Columbus. The Ohio and other mounds are natural products, not burial-places. The tribes were few in number, never numerous, and latterly diminished by European vices. They could not have cut down trees, and cleared and shaped timber by fire.

The language of California has no affinity whatever with that of Mexico, though so near; and their manners, customs, and superstitions, have no resemblance to any thing Asiatic, though they say they came from the North. Their three tribes speak languages altogether dissimilar; and a Spanish missionary says, there are in this peninsula 17 languages.

The chiefs of the Osage and Missouri Indians are called Incas.

The coinage, in 1837, was 232,200 gold pieces, and 7,200,200 silver. The mines produced 5 million dollars' worth of gold.

Down to Michaelmas 1837, 61½ millions of acres of land had been sold, at 1·27 dollars.

Half per cent. annually is paid out of the capital of 29 banks, to form a fund for the payment of the creditors of any bank that may fail, and their capital is 6,494,000 dollars. Other banks had 22,323,460.

The currency is paper, dollars, and copper coins, in cents, or the 100th of a dollar.

In 1835, the United States revenue was—

Customs	19,391,311	dollars.
Sale of lands	14,757,601	do.

And sundries—making receipts 35,430,087, and a balance in hand of 8,892,856.

The expenditure was only 17,573,142

Civil List, Embassies, &c.	3,721,261
Military	9,420,313
Naval	3,864,939

And sundries.

The balance in hand was 26,749,803, divided among the States in 294ths, according to electoral votes. New York received on 42 shares 5,352,694 dollars; and Pennsylvania 3,023,353 on 30 votes. There are no public taxes besides the customs on fo-

reign goods; so that the returns are substitutes for local rates.

The balance, in the American treasury, of revenue over expenses, were, within 1835, 26¼ millions dollars; within 1836, 46 millions; and, within 1837, 34$\frac{1}{5}$. The revenue, within 1837, was 46 millions, and the total expenditure 35¼ millions.

The public expenditure of the United States, in 1836, was 31 millions of dollars; and, in 1837, 39 millions.

3 per cent. of the sale of lands is devoted to local improvements, and 2 per cent. to education.

There are 709 banks, and 173 branches, with 440 millions of dollars for capital. The United States Bank has 35 millions.

The American dollar is 371¼ grains of pure silver, or 416 standard silver.

The Eagle is 232 grains of pure gold; 4·87$\frac{7}{120}$ dollars are equal to a sovereign.

In 1834-5-6, the United States imported 43½ millions of dollars in bullion, and exported 10⅘. They coined 4$\frac{1}{7}$ in gold, 3⅔ in silver, and 23,100 in copper cents and half cents. In 54 years, the United States coined in gold 22 millions dollars; in silver, 46⅘; and, in copper, ⅘. In half dollars, 84½ millions pieces.

The mines of Mexico and South America, per Humboldt, yield, in sterling value, 1,273,000*l.* gold, and 7,168,000*l.* silver per annum. Jacob estimates the produce from 1500 to 1810 at 9⅘ millions, and from 1811 to 1820, 3½.

In 1837, to prevent the exportation of specie to meet undue commercial speculation, all the banks stopped payment in specie; but their circulation was then limited by law, and no dividends paid till resumption.

The government (U. S.) gave 16 millions in 46 years, to old soldiers, colleges, and schools.

Most of the States have separate debts for local improvements, provided for by sale of lands, by profits, or surplus revenues.

The United States have 558 banks, chiefly joint-stock, whose average capital is half a million of dollars. Their credit affords currency to their notes of all values above a quarter of a dollar. Labour, however, is in demand, and land in surplus, hence the effect of so vast a currency is not felt by the people at large. There is a safety-fund of 3 per cent. on all the capitals, as guarantee for the payment of all issues in full; and each bank is obliged to state and publish its whole concerns annually, to a committee of the legislature. If a bank is not connected with the *safety-fund*, every proprietor is answerable for all the obligations.

The post-office routes in the United States are 118,264 miles. The bye-posts make a distance of 27½ millions of miles. At 25 cents for 400 miles, the post-office revenue over expenditure is ⅘ million of dollars. Newspapers pay a cent, and magazines a cent and a half per royal sheet of 24 pages.

3000 miles of double railroad are in preparation in the United States.

In the United States there are already 28 railways, extending 1000 miles. The New York and Erie is in progress, 506 miles, at 4230*l.* per mile. The Cincinnati and Charleston will exceed 650 miles.

America (United States) has 3026 miles of canals. The Hudson and Erie is 363 miles with 84 locks, rising 689 feet.

The canals completed, in 1837, are 2000 miles; the railroads 1500. Other railroads are in progress, connecting Boston with New Orleans. The cost per mile is 7000 dollars for single tract, and 13,000 for double; the cost chiefly borne by the Provincial funds.

The roads in the United States are improved by the post-office revenues.

The projected railroad from New Orleans to Nashville is 564 miles!

In 1825, the Congress of Mexico decreed the construction of a canal across the isthmus of Tehuantepec, to join the two oceans in lat. 18, lon. 94.

51,000 Indians, by treaty, have removed west of the Mississippi, and 280,000 remain west of that river, in 46 tribes. The Creeks at 20,000; the Choctaws 15,000; the Sioux 21,600; the Pawnes 12,500; the Camanches 19,200; the Pagans 30,000; the Assiniboins 15,000; the Appaches 20,280; the Gros Ventry 16,800; the Entaws 19,200, and the Blackfeet 30,000. They have 66,500 warriors.

The American government having purchased the lands from the near tribes of Indians, have removed them into other districts; but these being claimed as the hunting grounds of other previous occupants, bloody rencontres have taken place.

The Esquimaux appear to inhabit the entire coast of the North American Ocean, from Greenland to the south of Behring's Strait, with uniformity of language and manners. The Esquimaux, seen by Parry, are five feet five, and the women five feet. They live in huts built of ice and snow, entered by long passages, and divided into apartments, with well-constructed dome roofs, lighted by a sheet of ice, and kept warm with lamps. They have the Tartar physiognomy.

There are 8 law schools and 95 endowed colleges in the 26 States, in most of which true learning is as well cultivated as in any of the European universities. Pennsylvania has 670 students. Harvard 422, and Yale 570. There are, also, 28 medical schools, with 1 or 200 students in each.

The United States are distracted and disgraced by religious divisions. The Editor of the American Almanac enumerates no less than 29 denominations! The Methodists with 6 bishops, the Baptists, and the Presbyterians, appear to be the favourites. The Shakers, Tunkers, &c., are almost nominal. In this chaos, there are 443 Catholic congregations with 14 bishops, and 850 Church of England with 18 bishops. The Methodists have 3039 travelling preachers, and nearly as many local preachers! The conferences, camp-meetings, &c., are public nuisances to all the educated community.

MONETARY AND FISCAL.

The Finance Accounts of the United Kingdom, for the Year ended 5th Jan. 1839.

Ordinary Revenues and Extraordinary Revenues, constituting the Public Income of the United Kingdom, for the Year ending 5th Jan. 1839.

	Gross Receipts.	Payments into the Exchequer.
Customs	23,210,881	20,846,216
Excise	15,493,310	13,632,171
Stamps	7,428,060	7,050,582
Taxes	3,907,264	3,654,818
Post Office	2,467,216	1,656,993
1*s.* in the Pound, and 6*d.* in the Pound on Pensions and Salaries, and 4*s.* in the Pound on Pensions	6,759	6,831
Crown Lands	388,642	180,000
Small Branches of the Hered. Revenue	4,575	4,575
Surplus Fees of Regulated Public Offices	72,525	72,525
Money received from the E. I. Company	60,000	60,000
From the King of the Belgians	35,000	35,000
Imprest Monies	126,853	126,853
Unclaimed Dividends	6,861	6,861
Public Income of the United Kingdom	53,207,951	47,333,459

In Ireland, the gross was £4,677,076, and the net £4,041,429.

EXPENDITURE.

Interest and Management of the Permanent Debt	£24,355,344
Terminable Annuities	4,183,965
Total Charge of the Funded Debt	28,539,310
Interest on Exchequer Bills	720,928
Civil List	385,621
Annuities and Pensions for Civil, Naval, Military, and Judicial Services	609,544
Salaries and Allowances	213,352
Diplomatic Salaries & Pensions	182,0 8
Courts of Justice	791,728
Miscellaneous Charges	222,884
Army	6,815,641
Navy	4,520,428
Ordnance	1,384,681
Miscellaneous	2,792,539
Insurrection in Canada	500,000
	47,678,687
Expences above Income	345,228
Income	£47,333,460

Balances in the Exchequer on the 5th January, 1839, £4,594,884.

The gross amount of all the expences of collecting the Customs, was £1,300,807; Excise, £1,037,962; Stamps, £168,034; Taxes, £233,465; Post-office, £669,756; Crown Lands, £40,789.

Rate per Centum, for which the Gross Receipt was collected, 6*l.*

Besides the charges of collection, there are other payments out of the income, amounting to £591,120, in which £165,998 was made out of the Crown Lands, besides the £40,789 for expences of collection.

EXCISE.

An Account of the Gross Receipt and Net Produce of the Revenue of Excise in Great Britain, in the Year ended 5th Jan. 1839.

ENGLAND:

Auctions	£248,629
Bricks	410,822
Glass	619,026
Hops	302,906
Licences	795,368
Malt	4,274,684
Paper	424,145
Post-horse Duty	217,762
Ditto Licenses	3,528
Soap	732,043
Spirits	2,520,024
Sugar from Beet-root	103
Vinegar	20,827
Law Costs recovered	906
Fines and Forfeitures	6,841
Total	10,577,599

SCOTLAND:

Auctions	23,558
Bricks	7,512
Glass	38,136
Licences	101,642
Malt	373,100
Paper	93,507
Post-horse Duty	19,658
Ditto Licences	317
Soap	76,967
Spirits	1,437,324
Vinegar	174
Law Costs recovered	439
Fines and Forfeitures	3,274
Total	2,170,920

IRELAND

Auctions	£13,000
Glass	9,829
Licences	126,191
Malt	285,314
Paper	22,226
Spirits (Home-made)	1,509,841
Vinegar	459
Total	£1,966,860

The Salaries to Officers on the Establishment are 607,816*l.*

Within 1832, the SPIRITS distilled in England were 3,788,068 gallons; in Scotland 9,979,038 gallons; and in Ireland 9,260,920 gallons. Total 21,028,026 gallons. Duty for home consumption was paid on 20,778,558 gallons, *i. e.* 17·26 for England, 4·86 for Scotland, and 8·66 for Ireland. This gives the ratio of drunkenness, accord.

ing to population, as 4·54 for England, 24·3 for Scotland, and 12·39 for Ireland.

In distilling *whiskey*, 2 parts are barley and 1 malt. When more barley, oat-seeds are added. Hollands is made from 1 malt and 2 rye-meal, and only 1000th yeast added to the ferment. Juniper and hops give the flavour.

In making *Rum*, 12 gallons of molasses and 100 of water make 14 or 15 of spirits, 1 to 10 over proof.

Stamps.

Net Produce of the Revenue of Stamps in Great Britain, including Hackney Carriages, and Hawkers' and Pedlars' Licences.

Deeds and other Instruments, not included under any of the following Heads	£1,542,388
Probates of Wills and Letters of Administration	843,998
Bills of Exchange	516,263
Bankers' Notes	28,343
Composition for the Duties on the Bills and Notes of the Bank of England, and of Country Bankers	91,317
Receipts	157,951
Marine Insurances	250,590
Licences and Certificates	212,578
Newspapers and Supplements, and Papers for Advertisements	204,590
Medicine	26,107
Legacies	1,276,597
Fire Insurances	852,372
Gold and Silver Plate	80,943
Cards	11,960
Dice	1,872
Advertisements	111,899
Stage Carriages	494,234
Hackney Carriages	46,185
Penalties in Law Proceedings, and Costs received	495
Total	£6,750,741

The Salaries to Officers on the Establishment are £53,871.

The Stamps, &c. for Ireland are £461,747.

Taxes.

Net Produce of the Revenue of Taxes in Great Brit., in Year ended 5th Jan. 1839.

Land-Tax on Lands and Tenements	£1,184,830

ASSESSED TAXES.

Schedule:—	
A. Windows	1,262,561
C. Servants	201,018
D. Carriages	442,757
E. Horses for Riding, &c.	315,023
F. Other Horses and Mules	62,453
G. Dogs	156,199
H. Horse Dealers	13,173
I. Hair Powder	6,367
K. Armorial Bearings	63,814
L. Game Duties	161,366
Composition Duty	32,389
Penalties in Law Proceedings and Costs received	1,022
Total	£2,718,142

The Salaries to Officers on the Establishment are £61,442.

Post-Office.

Net Produce of the Post Office Revenue of Great Britain, in Year ended 5th Jan. 1839.

Unpaid Letters Outwards, and Paid Letters Inwards, and Ship Letters charged on Country Postmasters; Unpaid Letters Inwards, and Paid Letters Outwards, collected by Letter Carriers, &c., in London and Edinburgh; By and Cross-road Letters	1,833,740
Two-penny and Penny-post Letters at London and Edinburgh	134,313
Letters charged on the Postmasters in the W. Indies and British North America	64,616
Postage of Letters received by the Windowmen, &c., of the Foreign Office	81,862
Miscellaneous Receipts	2,264
Total	£2,116,798
The Salaries to the Postmaster-General, Officers, and Clerks in the London and Edinburgh Offices, and Wages and Allowances to Letter Carriers, Messengers, &c.	86,261
The Salaries and Allowances to Deputy Postmasters & Agents in Gt. Britain and the Colonies	111,485
The Salaries and wages to Officers and Letter Carriers in the Twopenny Post Office	48,890

PARLIAMENTARY GRANTS:—

To the Duke of Marlborough	£3,625
To the Duke of Grafton	3,407
To the Duke of Schomberg	2,900
Total	£256,568

IRELAND.

Unpaid Letters Outwards, and Paid Letters Inwards, and Ship Letters, &c., charged on Country Postmasters; Unpaid Letters Inwards, and Paid Letters Outwards, collected by the Letter Carriers in Dublin; By and Cross-road Letters	224,839
Two-penny and Penny Post Letters at Dublin	4,042
Miscellaneous Receipts	598
Total	£229,480

No less than £137,109 are expended on the separate form of Civil Governments in Scotland, chiefly in prodigal salaries and pensions; among others, £4,300, £4,000, £2,600, and £2,000 to Judges; £3,000 to a Chief Baron; £4,000 to a Chief Commissioner; £2,775 to a Lord Privy Seal, and a hundred others, chiefly sinecures, and reliques of useless feudality!

Funded Debt.

Sums paid in the Year ended 5th January, 1839, in respect of the Public Funded Debt.

South Sea Company, Interest and Management of their Ann.	£310,238
Bank of England, for Interest and Management of the Stock created by Loans to Government at various periods	336,032
Bank of England, one year's Management, due 5th April, 1838, on the Capital of the Unredeemed Debt	133,566
Interest on £3 p. c. Consol. Ann.	10,737,964
— Reduced	3,807,552
— 12 Geo. I.	24,799
£3 10s. Annuities	370,508
— Red. Ann.	2,322,897
— Ann. (New)	5,105,539
£5 Annuities	21,354
South Sea Company	9,197
Total	£23,179,651
IRELAND:	
Interest on £4 and £5 per cent. Bank Annuities	115,384
£3 p. c. Con. Ann.	94,237
— Red. Ann.	3,619
£3 10s. Ann. 1818	506,545
— Red. Ann.	34,280
— Ann. (New)	417,951
£5 Annuities	333
Debt and Management	£24,344,491
Exchequer and Tontine Ann.	17,563
Long Annuities, expire 1860	1,295,302
Ditto, Ireland	136
Life Annuities	822,634
Annuities for Terms of Years	1,440,529
Life Annuities	8,976
Annuities for Terms of Years	306
Irish Life Annuities, with the benefit of Survivorship	40,073
Bank of England, on account of the Annuity purchased of the Trustees of Naval and Military Pensions and Civil Superannuations	585,740
Total annual Payments and Charges on account of Funded Debt	£28,553,754

Capital of Public Funded Debt.

Bank Annuities, 1726, £3 p. ct.	£825,333
Consolidated Annuities ditto	357,019,936
Reduced Annuities ditto	125,416,272
£3½ per cent. Annuities, 1818	10,690,794
£3½ per cent. Red. Annuities	66,295,138
New 3½ per cent. Annuities	146,012,625
New 5 per cent. Annuities	438,240
£1,294,586 16 10 Long Annuities, at 25 years' purchase	32,364,671
Annuities for terms of Years £1,046,354 7 6 (after deducting the Annuity of £355,822 10 6 held by the Bank,) at 25 years' purchase	26,158,859
Total	£765,221,871

Total sum paid the Bank of England for management	£139,145
Paid the South Sea Company	5,900
Expences of the National Debt Office	11,900
Interest on Exchequer Bills	720,928

Pensions,

Appropriated to the Charge of the Civil List:—The three Royal Dukes have Pensions of £21,000; four Princesses, £13,000; Queen Dowager Adelaide, £100,000; (!) Duchess of Kent, £30,000.

There are, also, £35,000 of Naval and Military Pensions; £51,000 for unknown Civil services; £34,000 for unknown Judicial services; £99,000 for Court Pensions; and £90,000 for Irish Pensions, chiefly for unknown services. Total Pensions £624,642.

£216,125 is also paid in Salaries, chiefly to sinecurists,—as £1026 to an Inspector of Anatomy, in Great Britain, and £487 10s. in Ireland, &c. &c.

£139,553 is paid for Diplomatic Agents and Secretaries,—as £10,000 and £1,952 to France; £9,900 and £862 to Austria, &c. &c., on an equal scale of profligate waste. £52,420 is then superadded for Pensions to the same parties.

Abstract of the prodigal Salaries, Pensions, Sinecure Allowances, &c. &c. in the Judicial departments.

For Courts of Justice and Police England	£213,256
Ditto Ireland	458,667
Compensation for regulated Law Offices	123,835
	£795,760

The two Chief Justices of the Bench and Common Pleas have £8,000, the Chief Baron of the Exchequer £7,000, the other twelve Judges £5,000 each. The sinecure of Chief Clerk £7,700. The Filacer £4,496. The Custos Brevium £2,090, &c. &c., all equally astounding to tax-payers.

Other payments are for Interest and Sinking Fund on Russian Loan, raised in Holland, £101,686; Annuity for Barracks in the Regent's Park, £5,400; Greenwich Hospital, towards support of, £20,000; Commission of West India Compensations, £26,175; Interest on account of the Compensation, £11,506; Secret Service, £10,000.

Police Constabulary, £175,227.

Cholera Expences, £5,258.

County Treasurers for Boards of Health, £7,808.

Army and Navy.

Sums issued in the Year ended 5th January, 1839, for the Service of the Army.

Supply, anno 1837	£2,051,205
1838	4,724,435

Sums issued in the Year ended 5th January, 1839, for the Service of the Navy.

Supply, anno 1837	£1,345,428
1838	3,175,000

Sums issued for the Service of the Ordnance.

Supply, anno 1837	. .	£580,940
1838	. .	803,741

PUBLIC WORKS.

	1837. £	1838. £
Repairing Marlborough House . .	12,000	
Rebuilding Houses of Parliament . .	86,000	8,607
Temporary Accommodation, ditto . .	5,095	12,000
Prison, Isle of Wight .	25,000	4,185
Enclosing Ground opposite the Nat. Gallery	2,000	

CIVIL DEPARTMENTS.

Household of the Lord Lieutenant of Ireland . .	£10,337
Salaries of the Chief and Under Secretary's Office of Ireland .	16,601
Salaries and Contingencies, Treasury	33,006
Ditto Home Office	16,035
Ditto Foreign Office	35,000
Ditto Colonial Office	13,050
Ditto Council Office	16,154
Salaries and Expences of Houses of Parliament . .	40,787
Secret Service (£10,000) .	27,900

LAW AND JUSTICE.

Insolvent Debtor's Court .	7,000
Police of Dublin . .	22,655
Convicts at Home and Bermuda	48,552
Ditto, New South Wales and Van Diemen's Land .	244,949

COLONIAL AND CONSULAR SERVICES.

Civil Government, Bahamas .	1,511
Ditto Prince Edward's Island	1,567
Ditto Bermudas . .	2,361
Settlement, Western Australia .	1,582
Agents of Emigration (!!!) .	2,691
Salaries to Governors, W. Indies	6,000
Education of Negroes . .	8,565
Support of Captured Negroes .	16,000
Salaries to Consuls at Canton .	68,539
Magistrates, West Indies .	67,363

ALLOWANCES AND GRATUITIES FOR CHARITABLE AND OTHER PURPOSES.

Commissioners for the Poor Laws, (Expences) . .	41,250
Vaccine Establishment . .	1,850
Refuge for the Destitute .	3,000
Distressed Poles . .	8,380
Protestant Dissenting Ministers, Poor Fr. Refugee Clergy, &c.	4,010
Protestant Dissenting Ministers, Ireland . . .	15,859

EDUCATION, SCIENCE, AND ART.

British Museum, Expenditure of	20,601
Steam Navigation to India .	31,816
Roman Catholic College, Ireland	6,696
Royal Dublin Society . .	3,303
British Museum, New Buildings at	10,110
National Gallery, Works .	4,362

FOR SPECIAL AND TEMPORARY OBJECTS.

Commissioners for preventing Slave Trade . . .	10,000
Inspectors of Factories . .	5,720
Inspectors of Prisons . .	2,467
Revising Barristers . .	27,000
Commission on Railways, Ireland	9,000
Public Records: Binding, &c.	8,200
Commis. for Hand-loom Weavers	3,700
Expences of Coronation . .	69,421

Balances in the Exchequer, 5th Jan. 1839.

Consolidated Fund in Cash .	£3,465,175
Sugar Duty . . .	470,399
In Exchequer in Ireland .	659,310
Total .	£4,594,885

TOTAL PUBLIC DEBT.

Balance due to Public Creditors 5th January, 1839, including Management . .	730,028,648
Annual Charge . .	27,473,559
General Total Debt, Ireland .	33,774,915
Annual Charge . .	1,195,773
Great Britain and Ireland, Tot.	763,803,563
Annual Charge . .	28,669,333

DEBTS.—GREAT BRITAIN.

Debt due to the South Sea Company, at 3 per cent.	.	3,662,784
Old South Sea Annuities	do.	3,497,870
New South Sea Annuities	do.	2,460,830
South Sea Annuities, 1751	do.	523,100
Debt due to the Bk. of Eng.	do.	11,015,100
Bank Ann. created in 1726	do.	825,083
Consolidated Annuities	do.	357,246,465
Reduced Annuities	do.	125,853,774
Total, at 3 per cent		£505,085,007
Annuities at 3½ per cent. 1818		10,628,549
Reduced 3½ per cent. Annuities		66,212,024
New 3½ per cent. Annuities		145,834,453
New 5 per cent. Annuities	.	427,088
Total, Great Britain		£728,087,123

IN IRELAND.

Irish Consol. Ann. at 3 per ct.	£3,155,233
Irish Reduced Ann. ditto	120,363
£3½ per ct. Deben. and Stock	14,450,260
Reduced 3½ per cent. Annuities	969,533
New 3½ per cent. Annuities	11,927,745
Debt due to the Bank of Ireland at 4 per cent. . .	1,615,384
New 5 per cent. Annuities .	6,661
Debt due to Bank of Ireland, at 5 per cent.	1,015,384
Total, Ireland .	£33,260,566

The Donations and Bequests are	£253,046
Stock Unclaimed, 10 years	278,888
Unclaimed Dividends . .	892,100
Total Unfunded Debt and Demands outstanding . .	29,957,32[illegible]
Printing and Stationery for the Public Departments . .	92,796

Gross and Net Produce of the Duties of Customs, in the year ended 5th January, 1839, compared with the Produce of the preceding year.

	1838.	1839.
	£	£
Gross Duties Inwds.	22,688,806	22,966,214
———— Outwds.	98,102	115,586
Total Gross Receipt	22,786,908	23,081,8 0
Payments :—		
On British Refined Sugar	496,948	578,966
Other Articles .	179,290	202,887
Allowances on Damages, &c. .	167,581	63,125
Total Payments	843,819	844,978
Net Receipts of Customs .	21,943,089	22,236,822

The net produce of the INCOME of the United Kingdom was, on the 5th of April of each year,—

1836..........46,180,240
1837..........48,453,068
1838..........46,090 543
1839..........47,833,118

EXPENDITURE in the same years,—

1836..........45,003,940
1837..........46,590,245
1838..........47,519,077
1839..........48,263,443

In 1836, the Income exceeded the Expenditure 137,630*l* ; and, in 1837, 1,862,823*l.* ; but, in 1838, the Expenditure exceeded the Income 1,428 534*l.* ; and, in 1839, 430,325*l.*

To April 5 1840, the estimated Income will be 48,128,900*l.*, and the Expenditure 47,988,954*l.*

The Unfunded Debt has been, April 5, 1836, 28 504,850*l.*, in Exchequer-Bills ; in 1837, 25,394,450*l.* ; in 1838, 24,043,850*l.* ; and, in 1839, 24,025,650*l.*

N. B.—*The preceding are the Fiscal and Monetary Tables published, for the information of Parliament, by the British Government. They include, in fact, the whole subject of British money affairs.*

Taxes are a portion of the aggregate net incomes of the people. These incomes are fractions of the entire profits of national products, and those of foreign trade ; for these include the incomes of the entire community, whatever shapes they may assume, or whatever may have been their mixed source or origin.

The best publicists determine that the *tolerable* proportion is a fifth ; the *burthensome* proportion a fourth ; the *oppressive* proportion a third ; and the *revolutionary* proportion more than a third.

The first question, of a wise financier, refers to the net income of the people. If it be 200 millions, 40 may be assessed, or from 40 to 50. Profits depend, however, on prices, on steady or rising markets, and on the fixity of money. A currency of 50 millions may sustain profits of 200 ; but, if reduced to 40 millions, the profits would be under 150 ; and, if to 30 millions, the profits would not be 100. If, in the first case, taxes were 50 millions, or a fourth, they could not, in the second, be above 37 millions ; and, in the third case, but 25 millions.

Of course, as the revenue of a government can arise only from the actual profits of the whole people, so all taxes ought to be brought home to those profits. If 50 people are employed by a man who gets 10,000*l.* a year, it would be absurd to tax the 50, whose indemnity must be sought from their employer.

Thus, if an ignorant government should tax the articles consumed by them at 5*s.* each per head per week, the profits of dealers would raise this 5*s.* to 7*s.*, and for 7*s.* thus paid, the 50 would reasonably require 8*s.*, *i. e.* the employer would have 20*l.* a week to pay, instead of 12*l.* 10*s.* on his profits.

The landlord, to indemnify himself, raises his rents, the farmer his produce, &c. &c. and taxes thereby create privations in those who constitute the last term in the social series, and who have no stock to raise. But, as of *nothing nothing can come*, and as the fiscal minister will have his amount, so it is absolutely certain that, whatever be the shifts or appearances, the profits on real property must ultimately pay the whole, together with 5, 10, 15, and 20 per cent. assessed by manufacturers, dealers, &c. on value and risks, as augmented by the taxes. We might as well attempt to shift the pressure of a weight on the earth, by the intervention of springs or levers, as attempt to shift, in the actual result, the weight of taxation from the real profits of land, mines, and foreign trade. All evasions must, in fact, be made in a vicious circle ; and, in the end, an indirect tax, whatever it be, must reach real property and profits in its amount, and with aggravated force, in all the intervening charges.

Between 1793 and 1826, *i. e.* in 34 years, the British government raised, by all its means of taxes and loans,

2,476,334,216*l.*, OR, ABOVE 72 MILLIONS PER ANNUM.

And it expended, in the same period, 2,492,665,240*l.*

Of these enormous sums the CUSTOMS yielded 309½ millions, the EXCISE 688½, the ASSESSED and PROPERTY TAXES 363¾, the STAMPS 165½, the POST-OFFICE 39½, LOTTERIES nearly 11, LOANS and FUNDING 722.

Of the enormous expences, the INTEREST of the debt absorbed 891½ millions, the ARMY 598, the NAVY 422½, the ORDNANCE 95, DIRECT SUBSIDIES FOR ALLIES 55, the SINKING-FUND 318½, LOSSES BY EXCHEQUER-BILLS, &c. 57.

It far EXCEEDED, in less than a generation, the total of all the taxes and public expenses in 1000 years, or from the reign of Egbert,

the first king of England, in 827, down to 1826.

Marshall, considering the exchequer-bills, on and off, as part, makes the amount another 1038 millions.

In the age of Henry V. the taxes were but 1100*l.* per week; in that of Cromwell, 29,000*l.*; at the Revolution, 39,000*l.*; in the reign of George II., 150,000*l.*; and, in 1833, nearly 1,000,000*l.*, or TEN THOUSAND TIMES more than in the reigns of Henry V. and VI.

Taxes fall on labour, simply because there is a surplus of labour, and supply exceeds demand. 1*s.* 2*d.* per day from every operative and labourer, taking their number at 3 millions, pay the 60 millions of rates and taxes in the United Kingdom. Other property has risen 3. 4, 5, or more times its nominal value in 1689, just as the demand accorded with the supply. The rise, too, has been facilitated, by debasing and increasing the currency by paper. In 1689, land let for 4*s.* per acre, which now produces 30*s.* or 40*s.* per acre; while labour, which then got 6*s.* or 7*s.* per week, does not now average above 9*s* or 10*s.* Abstractions from labour having, therefore, paid the whole of the taxes and rates, 3½ millions of labourers and operatives, at 7*s.* per week, or 18*l.* 4*s.* per annum, pay the 60 millions of rates and taxes. This is the entire secret of our public wealth.

Average taxation in half a century, for every 7 years, in pounds sterling, and ratio to 100,—

	£	*Ratios.*
1784 to 1790 ..	14,490,762 ..	100
1791 to 1797 ..	19,026,129 ..	131
1798 to 1804 ..	33,285,859 ..	229
1805 to 1811 ..	58 010,248 ..	400
1812 to 1819 ..	65,232,176 ..	450
1819 to 1825 ..	55,601,834 ..	383
1826 to 1832 ..	52,793,750 ..	364
1833 to 1838 ..	46,903,250 ..	323

In 1813, the revenues were 68¾ millions, and addition to the public debt 107½ millions. The highest revenue was 72·2 millions, in 1815; and the lowest, in 40 years, 19·25 millions, in 1792, when the interest of the debt was but 9¾ millions. The highest interest of debt was in 1816, 33 millions nearly.

In 1792, the gross amount of taxes was 19½ millions, the current annual expenditure 7¾, and the interest of the debt was 9,767,333*l.* In 1802, 8 years' war had raised the interest to 19,855,588*l.*; and, in 1816, 14 years' war had raised it to 32,938,751*l.* In 1817, the current expences were 22 millions; and lowest in 1835, or 15,884,649*l.*

The surplus revenue over expenditure, in 10 years, from 1828 to 1837, was greatest, or 5,850,169*l.*, in 1828; and, in 1830, 2,913,673*l.* In 1832, but 614,759*l.*; and, in 1836, 2,130,000*l.* Of these surpluses, (23,408,634*l.*) there has been applied to the purchase of stock, 17,644,178*l.*: and the remainder to the redemption of exchequer-bills. The two highest incomes of the 10 years were, 1828, 55,187,143*l.*, and 1830, 50,056,616*l.* The two lowest, 1833, 46,271,326*l.*, and 1835, 46,043,663*l.* In four quarters of 1832, there was a deficiency of 3½ millions.

The revenue of New South Wales, in 1836, was 330,285*l.*, collected from a gross free population of 35,094.

The revenue of the United Kingdom is, to that of France, as 117 to 113; to that of Austria, as 117 to 44; Russia, 40; Turkey, 36; Prussia, 21½; Spain, 18; Belgium, 8; Bavaria, 7; Portugal, 5; Sweden, 5; and Switzerland, 1.

In 12 years, the revenues of Ceylon were 4½ millions, and the expenditure 4¾; 24 roads, and 1100 schools have been established. The Cingalese have 21 castes.

In 1838, we imported 60 millions of luxuries and manufacturing commodities, and we exported nearly 44 millions of manufactures and produce. It is true the imports were taken at official, and the exports at real value; but Porter states that there is a near approximation of the two, and, taking 5 per cent. as the excess of the imports, the amounts then are 55 millions and 44, or 11 millions difference. Whatever it be, whether 11 millions or less, it is that balance against the United Kingdom which affects the Exchanges and drains the Bank.

The stamp-duties on bills were 841,450*l.* in 1815, and 845,750*l.* in 1818; 790,870*l.* in 1825; and 594,326*l.* in 1829. Owing to the ruin of credit, they fell to 578,815*l.* in 1826. At 750,000*l.*, with five renewals in the year, every pound's worth of stamps would represent about 400*l.* in bills, which, by 150,000 of stamps, would be 60 millions for the average amount of bills in circulation.

In 1836, the Customs yielded 23,951,719*l.*, of which London paid 12,156,280*l.*; Bristol, 1,112,812*l.*; Hull, 801,628*l.*; Liverpool, 4,450,426*l.*; Glasgow, 289,702; Greenock, 374,478*l.*; Port Glasgow, 104,292*l.*; Dublin, 898,630*l.*; Belfast, 366,718*l.*; Leith, 514,974*l.*; Newcastle, 307,275*l.*; Cork, 230,904*l.*

The legacy-duty, in 1834, was 1,239,012*l.*, average 4 per cent.

Clerks and book-keepers increased from 31,211, in 1820, to 44,059, in 1832; and riders, from 1664 to 2618.

As the probate-duty amounts to nearly a million per annum, at an average of 2½ per cent., this gives 40 millions for property annually bequeathed; and, as property changes hands in periods which may be taken as the length of reigns, or about every 22 years, so the property thus bequeathable, at the present rate of valuation, is about 880 millions. But, as there are many shifts to evade the probate-duty, it may be taken at a third more, or about 1150 millions, in relative time and value.

The number of riding and private carriage-horses, assessed in Great Britain, are about half a million. 1252 persons keep above 20, the highest assessment. 122,000 keep but 1, and 41,000 keep 2 and 3. The husbandry horses are about a million. There were, in 1833, 1057 race-horses, and 25,000 not 13 hands high. The horses used in posting, stages, mails, &c., on which each coach keeps 1 per mile, is not less than 100,000, and stage-waggon horses are about half

that number, making the whole about 1¾ or 1¾ million.

The number of horses above 13 hands, for riding and private carriages, in 1820, was 178,337; and, in 1832, 182,878. Those under 13 hands, in 1820, were 8699; and, in 1832, 24,639.

983,711, in 1820, paid duty as labour-horses.

The 4-wheel private carriages, in 1820, were 17,341; and, in 1832, 24,830.

Carriages let to hire, in 1820, were 344; and, in 1832, 602. The post-chaises were 5064 and 6761, and the stage-coaches 1654 and 3146. Four-wheels with one horse, in 1833, were 13,549. Two-wheels by one horse were 47,250 private, and 2625 let to hire. The total of these last, including 19,319 taxed carts, was, in 1820, 49,240, and is now 65,282.

The domestic male-servants, in 1820, were 85,344; and, in 1833, 104,841. In 1832, 108,000 paid duty as clerks, shopmen, &c.

Armorial bearings have increased from 22,627 to 25,179 in 13 years.

The taxed dogs, in the same time, increased from 312,311 to 337,951.

The stamp-duty on cards, at 6*d*., yielded, in 1833, 15,922*l*., shewing a consumption of 640,000 packs per annum.

5000*l*. per annum is allowed to the First Lord of the Treasury, Chancellor of Exchequer, Attorney-General, and Home Secretary; 14,500*l*. to the Lord Chancellor; 4500*l*. to the Foreign Secretary, and First Lord of the Admiralty; 4000*l*. to the Chancellor of Lancaster and Secretary for Ireland; and 3500*l*. to the Colonial Secretary and President of the Board of Controul and Master-General of the Ordinance; 3000*l*. to the Solicitor-General and Commander of the Forces; and 2500*l*. and 2000*l*. to other heads of departments.

The allowance to Ambassadors are enormous. 10,000*l*. at Paris; 9900*l*. at Vienna; 6300*l*. in Persia; 6500*l*. at Madrid; 11,500*l*. at St. Petersburgh; 5500*l*. at Washington; 6500*l*. at Constantinople; 5000*l*. at Lisbon; 4000*l*. at Munich; 4400*l*. at Naples; 5500*l*. at Berlin; 4100*l*. at Turin. Besides 15 others, at 3000*l*. and 2000*l*. each, and Secretaries, who do all the business, from 1200*l*. in Persia, and 1000*l*. at Paris and Petersburgh. About 120,000*l*. for Ambassadors and 15,000*l*. for secretaries. Besides services of plate, perquisites, fees, retiring pensions, &c.

The Forces, or defence of the United Kingdom, cost 12,716,897*l*., besides miscellaneous 2,411,457*l*.; and the debt costs 29¼ millions, making 44¼ millions of fixed and indispensible expences. Then there remains but 1¾ million for civil expenditure in Royal family, law salaries, diplomacy, pensions, &c., which amount to two and a half millions. Hence the deficiency on a net revenue of 46¼ millions, and the necessity of increasing it, if practicable, or lowering salaries, &c.

Salaries, and other expences of 10 different commissions, cost in two late years 53,000*l*. The Commissioners of Charities have protracted their labours for 15 years, at a cost which approximates the value of the charities.

The charities of England and Wales, in 1835, had a net income of 748,178*l*., of which rent was 540,565*l*., probably worth double. For education only, it was 197,248*l*.

There is a very useful public board for the loan of exchequer-bills, for public works, and fisheries, conducted by 28 commissioners, &c.

The Pension, &c. List, heretofore paid out of the Civil List, in 1836 came to 510,028*l*. The Diplomacy to 195,300*l*. The Judges to 98,000*l*., making above 800,000*l*. as paid by the old Civil List in addition to the 385,000*l*. now settled, and 300,000*l*. to the Queen Dowager and Princesses.

The Civil List settled on the Queen, by votes of the Parliament, is 385,000*l*. per annum, besides the revenues of the Duchies of Cornwall and Lancaster of unexplained value, but estimated at 100,000*l* per annum, and 1200*l*. per annum for annuities. 60,000*l*. is assigned for the privy-purse, 131,200*l*. for the household, and 172,500*l*. for current expenditure. Other 21,240*l*. for alms and favours.

300,000*l*. per annum is also apportioned to the several members of the Royal Family, *i. e.* 100,000*l*. to the Queen Dowager; 21,000*l*. to the Royal Dukes, including the King of Hanover; 50,000*l*. (except his returns) to the King of Belgium; 30,000*l*. to the Duchess of Kent; and 13,000*l*. to each of the Princesses.

On the accession of George the Third, the various revenues of the crown for Civil List, judicial and diplomatic purposes, were exchanged for an annuity of 966,000*l*., leaving also to the king, the droits of Admiralty and the revenues of Cornwall and Lancaster and Hanover. The revenues abandoned, in 77 years yielded 116¾ millions, and the payments were 69½. Latterly, George IV. and William IV. had 510,000*l*. for the Civil List only, and the judicial and diplomatic expences were paid by the public revenue, to an extent of 960,000*l*. per annum.

The coronation of George IV. cost 243,256*l*., that of William IV. 143,000*l*., and 70,000*l*. was voted for that of Victoria.

The ancient revenues of the crown were the fines, at death, of a year's rent of all lands, and other fines, and the power was sustained by the military service of all holders of land, or an equivalent in money. These were abolished by Cromwell, and taxation substituted.

It was one of the valuable precepts of Moses, that no Jew should take interest of Jew, but only of strangers; and, hence, it has followed that few Jews become poor, and collectively they enjoy greater wealth than other people.

Interest of money, or capital, ought never to be but a portion of the average profits of trade. A third leaves a third for the subsistence of the borrower, and a third for the risk and expences of his adventure. Profits

of 10 per cent. may afford 3 per cent. for interest, and of 15. 5 per cent.

Interest, under Justinian, was 12 per cent. In England, under Edward VI. it was forbidden entirely, from religious motives. By 37th Hen. VIII., ch. 9, it was fixed at 10 per cent. per annum. This act was revived by 13 Eliz. ch. 8, and 10 per cent. continued the legal interest till 21st James I., when it was restricted to 8 per cent. Soon after the restoration of Charles II., it was restricted to 6 per cent. By 12th Anne, stat. 2, ch. 16, it was fixed at 5 per cent. per annum; and so it continued until 1839, when the Bank raised it to 6 per cent.

Till the 15th century, no Christians were allowed to receive interest of money, and Jews were the only usurers; and, therefore, often banished and persecuted. In 1329, they were banished to the number of 15,060.

In the United States, as well as in England, money is limited in interest, owing to *the variable character of securities*, for the protection of the needy borrower. No profits of trade could accrue, nor any credit exist, if the interest of money were unrestrained on *commercial securities*.

Paper-money is convenient, and its conventional value in short periods answers social purposes; but it ought never to be forgotten that it is an alloy of the lowest intrinsic value. Its increases and decreases change all nominal values and time-bargains, and it is a very dangerous instrument in the hands of ignorant or wicked governments.

The paper currency, early in May 1839, was 38,716,467*l.*, *i. e.* 12,259,467*l.* country circulation, and 26,457,000*l.* Bank of England.—*Times.*

In 1838, same term, it was 41,175,511*l.*

Steadiness in the amount of currency, as warranted by experience, is the primary desideratum.

A million issued by a country banker to the factories in his district, is fifty times more beneficial than 5 millions issued by the Bank of England to wholesale dealers in London for general circulation. The former system fosters industry immediately, but the latter serves only to raise the price of commodities.

After paper money and great government expenditure raised the value of property, three valuations were made, between 1800 and 1814, of the total value of all property. Two of them made it one thousand and a quarter millions, and another made it two thousand and a quarter millions. England was taken, by the last valuation, as at 6; Scotland, 1; and Ireland, 2.

The transactions of 50 out of 70 London bankers, are from 4 to 5 millions per day, and they are balanced at the clearing-house for a sum, in cash, of 220,000*l.* On settling-days at the Stock-Exchange, &c. the amount is often 15 or 20 millions.—*Burgess.*

Capital means the representation of property; and, in poor countries, this property is generally real, and capital limited; but, in countries rendered wealthy by artifice, it is the representation of debt created by credit and confidence, between a lender and borrower. British capital, since 1780 or 90, has generally been of this factitious description, directly or indirectly, owing to the facilities of creating currency and borrowing, and to the increase of transactions.

According to the Lord's Report, the average paper currency from 1810 to 1818, was 45½ millions. Bank of England notes from 23 to 28 millions, and country bankers 15 to 23 millions. Gold was 4*l.* 11*s.* per oz., the maximum being 5*l.* 10*s.* in 1813.

Paper currency tends to raise the price of bullion in a country, but as it equally raises the invoice-price of exports, no difference ultimately arises to the merchant or manufacturer.

The necessary accompaniment of national glitter beyond its means, in the native produce of its soil and industry, is *universal debt*, as the consequence of credit and undue transactions. Money is lent and re-lent, creating debts for its amount; property is mortgaged, creating other debts; and goods and merchandize in multitudinous transactions generate debts, on six or nine months returns of the whole. Wealth, in fact, is measured by the mutual debts; and every man expends in proportion to his credit, or to the property which he can get into his hands.

A nation called poor may owe but 100 millions, and one might be considered wealthy whose mutual debts were 1000 millions, but the people of the United Kingdom owe to one another full 5000 millions; and this, in fact, has been their wonderful public wealth. Credit has had no reasonable limit.

We commonly forget, that for every creditor there must be a debtor; that for every revenue there must be many slaves; and that, for all ostentatious expenditure, there must be equivalent privation.

Nature and society cannot be forced. Action and reaction determine limits; and, when these are passed, useful results cease. We may choose between glitter and permanence, but both are incompatible. Reason, rightly exerted, demonstrates that no condition is so fitted for the health and happiness of man, as that in which he subsists by the sweat of his brow; while all attempts to evade this law of nature resemble the labour of Sysippus.

The currency at the Revolution was about 7 or 8 millions in gold and silver. It is now nearly as under:—

Bank of England notes....		18 millions.
Private Bankers	do.	8
Joint Stock	do.	4
Irish and Scotch	do.	10
Metallic currency		15
Total of ordinary currency		55

Bills and promissory-notes were almost unknown at the Revolution, and are not supposed to have exceeded a million; but they have lately amounted to 3 or 400 millions, and in many cases serve as currency, and greatly increase the effect of currency.

Stock receipts, Exchequer-bills, bonds of companies, also serve as currency, and increase its effect. The real and vertical currency is, at this time, full 120 millions, against 8 at the Revolution, 1688.

As, in banking, one-third is the usual reserve of specie to meet demands, and, as circulation is generally pushed beyond the prudent limit, we may conclude that the paper or debased currency is 4 times greater than the coin. The actual present relations of currency to that at the Revolution is, therefore, 4 times the present coin; and, if coin has doubled, then the present currency is 8 times that at the Revolution, and prices about 8 to 1 on the average of articles and property.

279,751 persons receive some amount of the interest of the public funded debt. 87,176 receive 5*l.*; 44,648, 10*l.*; 98,305 receive from 10*l.* to 50*l.*; 25,641 from 50 to 100*l.*; 14,701 from 100 to 200*l.*; 4495 from 200 to 300*l.*; 2827 from 300 to 500*l.*; 1367 from 500 to 1000*l.*, and 266 from 1000 to 2000*l.* 325 company and joint accounts receive from 2000 to 5000*l.* and upwards.

The January dividends of public interest are about 281,000 receivers, and the October about one-third the number, from 5*l.* to above 2000*l.*

There are 624,560 depositors in Savings' Banks, whose average amount is 30*l.*; 5715 Institutions average 60*l.*; and 5791 Friendly Societies average 186*l.* The total is 19,624,015*l.* The single deposits amount to 16 millions, the Institutions 288,000*l.*, and the Societies 3-4ths of a million.

Three per cent. consols averaged, in 1817, 77; in 1824, 94; in 1826, 79; in 1830, 90; in 1832, 83; and, in 1838, 92⅞.

The loans in money to foreign states, during the late French war, were 46,289,459*l.* and the stores and arms were in value 1,582,045*l.*

The average price of stock, bought by the Commissioners of the Sinking-fund, has been as under:

	£	s.	d.
1787	75	10	6
1790	76	15	11
1792	84	8	10
1793	89	12	8
1794	74	19	9
1797	60	2	5
1798	50	1	0
1803	70	1	2
1805	56	16	6
1810	68	8	1
1815	66	11	4
1820	71	19	3
1824	80	5	10

In 23 years, from 1794 to 1816, the average was 70*l.* 1*s.* 2*d.* The greatest fluctuations in the same year were March 1793, 97*l.* and Dec. 72*l.*; and March 1817, 68*l.* and Nov. 83*l.*

The National Debt was established at the Revolution, and certain taxes pawned to pay the interest, for the two-fold purpose of supplying William III. with money for his wars, and of attaching the creditors to the new government.

At end of the war, in 1697 ...	£21,515,772
At the peace of Utrecht	55,282,978
Peace of Aix-la-Chapelle	79,193,313
At the peace of Paris	133,959,270
Close of American war........	238,231,248
Close of the first French war ..	499,753,067
Close of war with Napoleon ..	699,315,561
Irish debt (1816)..............	83,944,904

The interest and expences of the debt, at sundry times, have been

In 1760	£4,700,000
1780	7,500,000
1791	9,250,000
1830	31,252,612
1839 .... about	29,000,000

Rises or falls in the funds are governed entirely by supply, or demand at the moment; or by speculations on the probability of supply, or demand. A rise may attend a low state of trade, from capital not being otherwise required, or a fall from improved trade. Prices are also affected by the relative strength of the two parties of *Bulls* and *Bears*, without any reference whatever to public events. It is with the stocks as with other commodities.

The 3 per cents were, on Dec. 10, 1752, at 106⅞, and on Sept. 20, 1797, at 47¼. After the panic, in February, 1826, consols fell from 83 to 74¼, and exchequer-bills from 10 premium to 22 discount.

The public debt of the United Kingdom is to that of France, as 1885 to 376; Austria 180; Russia 152; Prussia 75; Portugal 16; Belgium 83; and Spain 300.

Before the Revolution of 1688, the public revenue was under two millions, bills and promissory-notes were scarcely invented, or little used, and there was no paper currency. The necessity of borrowing led to the establishment of a banking company, and to an issue of paper; this to rival banks as banks of deposit; and, finally, to others through the country, as banks of deposit, and issuers of paper-money.

The present funding system, so specious a means of government extravagance, and so destructive of trade and industry, is ascribed to Bishop Burnet; but all our kings had been in the practice of pawning their revenues for temporary purposes, and wars of blood.

Exchequer-bills are, in effect, accommodation-notes of government, issued in anticipation of taxes at daily interest; and, being received for taxes, and paid by the Bank in lieu of taxes, in its dealings with the Exchequer, they usually bear a premium. At 2*d.* per day, they yield 2*l.* 10*s.* 10*d.* interest; and, at 2½*d.*, 3*l.* 3*s.* 6½*d.*; and, being equivalent to money, produce, in general, a premium, at least, equal to their interest. From 24 to 30 millions usually oppose the circulation of private bills.

The system of country banking commenced during the American war. About 1780, they were less than 50 in number. Their business was also effected by wholesale traders, who had banking correspondents in London. These became local bankers,

and increased so, that, before 1800, their numbers had swelled to 1000. Subsequently, they rose to 1100, or 1200, in the United Kingdom. Circumstances have since reduced their numbers; but, they continue to this time to be the universal negotiators, circulators, and holders of the wealth of the country.

The system of Joint-stock Companies in shares from 5*l.* to 100*l.*, is the means of bringing the necessary capital to bear on any objects. In England, they depend on the means of the subscribers; but, in the United States, state bonds, in anticipation of sales of lands, are lent in aid of the companies. Canals, railways, roads, harbours, mines, bridges, gas works, water-supplies, &c. are set on foot, and sustained in this way. In France, such companies are formed for trifling objects, as the publication of a book, periodical, &c. They generally pay good interest on the advances, but sometimes ruin all concerned; and, in their details, are exposed to frauds.

The Bank of Scotland, established in 1695, has 16 branches; the British Linen Company 27; the Royal Bank 1. They are all in Edinburgh, and chartered.

These banks, at once, afforded the vast loans to government, and used their credit and real and artificial capital, in sustaining manufacturing establishments, trade in general, mines, canals, agriculture, and all kinds of local improvements; while the London banks aided builders, merchants, &c. The wealth of the whole nation was thus in activity; and credit and industry were practical wealth.

There are 119 joint-stock banks, with 37,202 partners, and 670 branch establishments in the United Kingdom.

Scotland has now about 12 joint-stock banks, the chief of which are the British Linen, the Royal Bank, and the Commercial Bank, with their 74 branches.

The Bank of Ireland has a capital of 2½ millions, lent to government at 5*l.* and 6*l.* per cent. There are, also, in Ireland, 4 joint-stock banks.

The capital of the Bank of Ireland is 3 millions. Its notes are about 6 millions; 2 of which are under 5*l.*; and it has several branches. There are about 40 country banks in Ireland.

The banking-firm of Child and Co. was established in 1663. Hoare and Co. about 1675, and Snow and Co. in 1680. The Bank of England was established in 1694.—*Wells.*

Banks were of Venetian invention; and the first was contrived about 1150, to assist in the transactions of a loan, and called "*The Chamber of Loans.*"

The plan was carried by Venetians into foreign countries; and, the projectors being called Lombards, they gave name to the great banking-street in London. Its celebrity led to the establishment of similar public banks at Barcelona, in 1401; at Genoa, 1407; at Amsterdam, in 1609; in London, 1694; at Edinburgh, 1695; and at Paris, 1716.

The Bank of Venice was founded in 1171. The new Bank of Holland has a capital of 5 millions of florins. The new Bank of France of 90 millions of francs. The Hamburg is a bullion bank, receiving at 444 shillings per mark, and paying at 442. The Petersburgh Commercial Bank is on the Hamburg plan, and has a capital of 30 millions of rubles. The Philadelphia Government Bank has a capital of 35 millions of dollars. There are 350 in the United States, with capitals of 120 million dollars.

The Bank of France, at first, led to portentous consequences. For its legitimate purposes, there were 1200 shares of 250*l.* each; but, in 2 years, the government established *branches* through France. Louisiana was assigned to it, and 200,000 shares, of 25*l.* each, added. Afterwards the farming of tobacco, and the exclusive trade to India were conferred, on which 50,000 new shares were created; and, finally, it consisted of 600,000 shares. Speculation soon raised the shares to 50 and 100 times their original value, and those who held them made great fortunes in a few weeks; but alarm creating suspicion, they suddenly fell below their first value, by which thousands of families were brought to beggary. This was called "*Law's Mississippi Scheme.*"

This transaction begat, in England, a company for trading to the South Seas; and a similar mania seized on the English nation. There were 20,000 shares of 100*l.* each; and they rose, in a few weeks, to 50 and 100 times their value; but the secretary eloping with a large proportion of the capital, and it being discovered that fraudulent shares were issued, they fell in price as rapidly as they rose, and thousands were left in destitution. This was called the "*South Sea Bubble;*" and its temporary success gave rise to so many schemes and companies, that the year 1722 is generally called *the bubble year.*

A nearly similar mania took place in 1792, in regard to canal shares; and something of the same kind in 1825, when companies were formed for the most extravagant and most absurd projects; the shares in which, in their rise and their fall by the panic, which had other causes, involved hundreds in ruin.

Payments at the Bank of Ireland were also suspended in 1797, at the same time as the Bank of England. Its notes, at that time, were 621,917*l.*; but, in 1810, they were 3,192,186*l.*

76 country banks, and 7 London banks, stopped in the panic of December, 1825. At the same time, about 500 mercantile and manufacturing establishments, of the first class, were ruined; from 2000 to 3000 of the second class; and many thousands of shopkeepers, farmers, &c.; perhaps, one-half in Great Britain.

The quality of coinage in current transactions could never affect market prices, since,

if button-tops *passed* for shillings, this would affect no individual or local transactions. Nor would it operate in barter with foreign nations.

If 20 millions of accustomed currency in gold and silver support a public property at 1000 millions, or 50 times more, then a million, added in due time, raises the 1000 to 1050; or, if doubled by alloy, whether lead or paper, it raises the 1000 to 2000. The property, in each case, is the same in bulk, weight, and tale, but more currency swells its nominal value.

Within a nation any conventional value may be assigned to a coin; but, in foreign exchanges, the absolute value in weight is adopted.

It is a banking axiom, that a stock of *one-third* gold is an average guarantee against runs; and, it is therefore presumed, that the best paper is to gold as 3 or 4 to 1.

The new coinage of 5*l*.-pieces weighs 25 pennyweights 16·37 grains. The double sovereigns 10 pennyweights 6·548 grains. The sovereign 5 pennyweights 3·274 grains. The half-sovereign 2 pennyweights 13·637 grains.

Pitt, in 1800, valued the plate and jewellery of the United Kingdom at 200 millions. In 1834, the gold-plate duty was on 6116 ounces, and the silver on 1¼ million ounces.

In 1836, 1,787,782*l*. of gold coinage was issued, and 497,719*l*. of silver coinage, and about 19 millions in the 10 years after the panic; and about 42,000 of copper coin.

In 20 years, from 1810 to 1829, the coinage of *gold* amounted to 45,387,423*l*. 8*s*. 4*d*. During the same period, 9,149,411*l*. 4*s*. 1*d*. was also coined in *silver*. The gold coined in 1830, 1831, 1832, was 6,723,493*l*.

917 of 1000 weight, is the purity or *titre* of GOLD coins of England, United States, Portugal, Holland, Rome, Russia, and Austria; 900 of France; 901 and 875 of Spain; 996 of Naples.

The total of the French coinage of gold and silver, from 1805 to 1832, has been 140 millions sterling, or 3529 millions of francs, besides 2½ millions of copper, &c.

The total of the British coinage, in the same time, in gold and silver, has been 62,361,168*l*.

Humboldt estimates that America transmits 7 or 8 millions of gold and silver annually to Europe; half of which is exported to the East, an eighth coined, and the rest used in plate and jewellery.

By Devon's publication of the Issue Rolls, it appears, that, in 1360, the wages of carpenters, smiths, masons, &c. were 6*d*. per day; the king's valets, 12*d*. to 6*d*. per day; inferior servants 2*d*. or 3*d*. Wheat, in 1420, was 5*s*. 6*d*. per quarter, and malt 5*s*. Archers had 12*d*. per day, men at arms 2*s*., knights 4*s*., sailors 4*d*., masters 6*d*., boys 1*d*. The coronation-preparations of Edward I. cost 1100*l*. A barrel of gunpowder 3*l*. 10*s*., and, in 1420, 231 lbs. cost 4*l*. 16*s*. 4*d*.

In Edward IV., beer for the king's household was 7*s*. and 6*s*. the pipe.

Variations of prices arise from causes so intermingled, that no theory founded on any one cause is tenable. But, taking goods as in one scale, and money in another, prices must be as the relations of the two directly and universally.

Several authorities agree that present money is 15 times less valuable than in the reign of Edward III.

The Chancellor of the Exchequer to Edward III. received but 40 marks, and the Attorney-General but 15 per annum.

The wages of labour, in 1836, were as under—

Carpenters	29*s*. 0*d*.	per week.
Bricklayers	27*s*. 0*d*.	"
Masons	30*s*. 0*d*.	"
Plumbers	30*s*. 0*d*.	"
Tailors	20*s*. 0*d*.	"
Shoemakers	16*s*. 0*d*.	"
Hand-loom weavers	6*s*. 0*d*	"
Stocking-makers ..	10*s*. 0*d*	"
Cotton Spinners ..	27*s*. 0*d*.	"
Lace-makers	15*s*. 0*d*.	"
Wool-combers....	16*s*. 0*d*.	"
Seamen's wages ..	60*s*. 0*d*.	per month.
Labourers	10*s*. 0*d*.	per week.
Compositors	36*s*. 0*d*.	"
Average of wheat	48*s*. 6*d*.	per quarter.

Prices, of course, have some relation to cost of production; and this cost would, in a cycle of years, determine the mean price of the most fluctuating articles.

Between 1784 and 1790, *brandy* averaged 3*s*. 2½*d*. per gallon—the duty 7*s*. 7*d*. Between 1812 and 1818, 12*s*, 10¾*d*.—the duty 19*s*.; and, from 1819 to 1837, but 3*s*. 5*d*.—duty 18*s*. 9*d*.

Coals, from 1784 to 1790, averaged 22*s*. 6*d*. per chaldron—duty 7*s*. 2*d*. more; and, from 1805 to 1811, 40*s*. 5*d*.—duty 12*s*. 3*d*. more. Since 1833, 26*s*. per ton, and no duty.

Greenwich Hospital was, in 1800, 1812, and 1831, supplied with flour per sack, at 96*s*., 107*s*., and 60*s*. 5*d*; with meat per cwt. at 64*s*. 4*d*., 78*s*., and 44*s*. 4*d*.; with butter per lb. at 11*d*., 15½*d*., and 9¾*d*.; and cheese at 6½*d*., 8½., and 4¾*d*.

Bread and beer were cheaper in 1834 than in 1813, as 92 to 171.

Current prices, without duty, in 1833, per Marshall, of tea, were 1*s*. 9*d*. to 5*s*. 6*d*. per lb., but doubled by duty. Of cocoa 5*d*., coffee 7½*d*., pepper 3*d*. to 4*d*. Tobacco 3*d*. to 9*d*. Wines 2*s*. to 10*s*. per gallon. Rum 1*s*. 10*d*. to 2*s*. 10*d*. Brandy 2*s*. 6*d*. to 4*s*. Geneva 2*s*. 3*d*. Sugar 18*s*. to 35*s*. per cwt. Cotton-wool 3*d*. to 15*d*. Silk raw, 8*s*. to 20*s*., and thrown, 21*s*. to 29*s*. per lb. Rice 7*s*. to 20*s*.

The present value of a lease for 1*l*. per annum advantage at 6 per cent., is, for 7 years 5·58*l*., 14 years 9·29*l*., 21 years 11·764*l*., and 28 years 13·406*l*.—For 80 years it is 16·509*l*., for 99 years 16·61*l*., and for 100 years 16·617*l*.

The tables of Government annuities are constructed on the principle that women live longer than men. Thus a male of 15 can purchase an annuity of 20*l*. per annum for 411*l*. 5*s*. 10*d*.; but, a female of the same

age must pay 438*l.* 11*s* 4*d.* And, at 50, a man would pay 272*l.* 17*s.* 1*d.*, but a woman 312*l.* 14*s.* 10*d.*

When land is taken at 25 years' purchase, house property is estimated at 13·5*l.* When land is at 30, house at 16 4*l.*

The present value of an annuity, per annum, would be as many times the amount of the annuity as the figures beneath.

	4 *per cent.*	5 *per cent.*
5 years	4 45	4 33
10 years	8 11	7 72
20 years	13 59	12 46
30 years	17 29	15 37
40 years	19 79	17 16
50 years	21 48	18 26

Present values of money payable at those times would be redeemable in the same ratio for decrease.

A perpetual annuity would be 25 and 20 times the amount of the annual payment.

An annuity of 2*s.* 11*d.* per annum, accumulating at 10 per cent., amounts in 100 years to 20,000*l.*

Exchange between countries is by equivalent weights of gold or silver. When equal quantities can be obtained at A and B, the exchange is at par: when at A the same value can be procured for less than at B, the exchange is in favor of A, and below par at B, and *vice versa.* The rise above or below par, as bills are scarce or plenty, is according to the debts due from one to the other. If B owes A, and bills are plenty at A, the exchange at A falls on B, and the contrary; so that the course of exchange shows, generally, the balance of trade.

Usance is the customary period of drawing between countries. Between Holland, France, and Hamburgh it is a month, Spain and Portugal, two months, and Italy three. On America and the West Indies, the usance is 60 or 90 days after sight. Three days' grace are allowed in London and Berlin, six at Amsterdam, and twelve at Hamburgh.

The Exchange brokers of London afford the following information:—

Lisbon. A conto is a million of rees, value 215*l.*

Cadiz. A talega is 1000 dolls. value 200*l.*

The Spaniards make their fiscal statements always in reals vellon, value 2*s.* 2*d.*, and maravedies 34 to the real vellon.

			Sterl.
Amsterdam gives to London	(florins)	12	for £1
Paris	(francs)	25·40	"
Frankfort.........	(batzen)	151	"
Hamburg ..	(banco marks)	13·12*s.*	"
Genoa	(new lire)	26	"

Leghorn receives from London 48*d.* per 6 lire $\frac{61}{400}$

Spain " " "

(36*d.* for 1 dollars of 8 reals of plate.)

Agio is the sum allowed for difference in purity of coins.

Real exchange is the giving at one place an order for value on one coin to be received in the coin of another place in purity and weight.

At the par of exchange, 1*l.* sterling is equal to 25·2 francs; or, an English bill for 100*l.* at par, is equal to 2520 francs in Paris. If 100*l.* in London will buy a bill on Paris for more than 2520 francs, the exchange is in favor of London; or, if 100*l.* on London will not buy a Paris bill for so much as 2520 francs, then the exchange is in favor of Paris. The par of exchange with London and Amsterdam is 36·8 schillings and pence for a pound sterling; and, with Hamburgh, 34·3¼ schillings and pence.

£1 per annum at compound interest, at *five* per cent. will, in 27 years, be 54*l.* 14*s*; in 37 years, be 101*l.* 12*s.* 6*d.*; and in 50 years be 209*l.* 7*s.* At *four* per cent. it is 66*l.* 4*s.*, or double in 33 years; 100*l.* in 41 years; and 152*l.* 13*s.*, or treble in 50 years. At *two* per cent. it would, in 50 years, be 84*l.* 11*s.* At *two and a half* per cent., 97*l.* 9*s.* At *three* per cent. 112*l.* 16*s.* At *six* per cent. 290*l.* 6*s.*, and at *seven* per cent. 406*l.* 10*s.* Hence, 100*l.* per annum, invested for 50 years, would, at five per cent., be 20,935*l.*, or quadruple the sum paid.

£1 at compound interest at 8 per cent., in 30 years, is 10*l.*; hence, a bad debt, or wasteful expenditure in any trade yielding 8 per cent. is ten times the loss in 30 years, and five times the loss in 21 years. At 5 per cent., 1*l.* borrowed is 2*l.* in 15 years; 3*l.* in 23 years, 4*l.* in 28, and 10*l.* in 48.

At five per cent. 10*s.* 6*d.* in hand entitles the payer to 1*l.* in 14 years; 5*s.* 3*d.* to 1*l.* in 28 years, 4*s.* in 33 years, and 2*s.* in 47 years.

By a sinking-fund of 1 per cent. at compound interest, a debt may be paid off in 43 years. But a national sinking-fund is absurd, because compound interest can only be drawn from a second party, and in a nation there is no second party from whom to draw it.

Rate of Interest, in even shillings, at different prices of 3 per cent. consols.

100	....	£3 0*s.*
91[illegible] to 93	....	3 5*s.*
90[illegible] to 90[illegible]	....	3 6*s.*
87[illegible] to 90[illegible]	....	3 7*s.*
87[illegible] to 88[illegible]	....	3 8*s.*
86[illegible] to 87[illegible]	....	3 9*s.*
85[illegible] to 85[illegible]	....	3 10*s.*
84 to 85[illegible]	....	3 11*s.*
82[illegible] to 84	....	3 12*s.*
81[illegible] to 82[illegible]	....	3 13*s.*
80[illegible] to 81[illegible]	....	3 14*s.*
79[illegible] to 80[illegible]	....	3 15*s.*
78[illegible] to 79[illegible]	....	3 16*s.*
77[illegible] to 74[illegible]	....	3 17*s.*
76[illegible] to 77[illegible]	....	3 18*s.*
75[illegible] to 76[illegible]	....	3 19*s.*
74[illegible] to 75[illegible]	....	4 0*s.*
73[illegible] to 74[illegible]	....	4 1*s.*

The Bank of England is banker to the government, receiving all taxes, and paying all dividends and outgoings for the public offices, for which it receives 140,000*l.* annually. Its issues of its own notes, as public currency, have been as high as 33 millions, but, in late years, about 18 or 20 millions.

No bank of issue can exist within 65 miles of London, and Bank of England notes are made a legal tender, except at the Bank, and its branches.

The Bank of England gains, by its various transactions, from 2½ to 3 millions; of which, it derived 251,896 for the management of the public debt, now 120,000*l*. less by law, and about ½ of a million from loans and discounts. It now divides 7 per cent. on its nominal stock of 14,552,900*l*. or 1,018,706*l*. It pays 70,875*l*. as a composition for stamps; and its losses and expences of clerks, &c. &c. were, in 1832, 428,674*l*. Its losses by bad bills averaged 31,000*l*. per annum, and by forgery 40,000*l*.

The Bank of England finds its profits, by its paper issues, are but 1*l*. 4*s*. 3½*d*. per cent.

Besides its London issues, the Bank of England makes issues through its 13 branches in the country, which average about 4 millions.

In 1718, the Bank of England notes in circulation were 1,829,930*l*. In 1754, the first bank-post bills were issued. In 1778, the issues were 7,030,680*l*.; and, in 1791, they exceeded 10 millions. In 1797, at the time of stoppage, the amount was only 8,742,530*l*.; and the bank-post bills 461,970*l*. In the same year, small notes were first issued, to the amount of nearly a million. In 1815, the notes above 5*l*. were 16,522,530*l*.; and, under 5*l*., 9,065,890*l*.; besides bank post-bills, 1,215,100*l*.: in all, near 27 millions.

The Bank-stock of 11,015,100*l*. is lent to government at 3 per cent.

The drains on the gold of the Bank of England arise from the national obligation to pay for its own domestic consumption. Our legitimate mode of payment is exchanging our superfluous produce in native commodities, or our overplus manufactures; but, if the demand for these is not equal to consumption, gold and silver are the only mode of balancing accounts. It is with a nation as with a manufacturer; when his waste or luxury raises his consumption beyond his returns from exports, there is no alternative but to pay from his capital in the precious metals. He may draw and renew (Exchequer) bills, and increase his paper issues; but these are shifts which do but accelerate and aggravate insolvency.

Marshall ascribes our social derangements to the unregulated use of machinery, the fixed amount of taxes, the jobbers in money and capital, and the gold standard. The new mechanical powers paid the expences of the late wicked 22 years' wars.

Before the Bank restriction, in Feb. 1797, the gold in circulation was estimated at 22½ millions, and by some much higher.—*Tooke.*

The dead weight is the amount of the military and naval pensions, accumulated during the war, converted into an even annuity of 585,740*l*. per annum, for 44 years, from March 1823, for 13,089,424*l*., which the Bank paid up in 5½ years. The amount repaid will, in 1867, have amounted to 25¾ millions; the 12¾, being profit and interest to the Bank, is kept by them.

Tooke has published the following Statement relative to the Bank, for every Seventh Year.

	£
31 August 1778.	
Circulation . . .	9,627,970
Deposits . . .	3,128,420
	12,756,390
31 August 1785.	
Circulation . . .	9,944,570
Deposits . . .	5,487,040
	15,431,610
31 August 1792.	
Circulation . . .	13,905,910
Deposits . . .	5,357,380
	19,263,290
31 August 1799.	
Circulation . . .	16,930,440
Deposits . . .	7,000,780
	23,931,220
31 August 1806.	
Circulation . . .	29,473,100
Deposits . .	6,215,020
	35,688,190
31 August 1813.	
Circulation . . .	40,106,080
Deposits . . .	2,712,270
	42,818,350
31 August 1820.	
Circulation . . .	23,846,120
Deposits . . .	8,211,080
	32,057,200
31 August 1827.	
Circulation . . .	23,199,320
Deposits . .	10,463,770
	33,663,090

Average Quarterly Account of Circulation.

	£
1834.	
January 1. . . .	18,216,000
July 1. . . .	18,895,000
1835.	
January 15. . . .	18,012,000
June 30. . . .	18,315,000
1836.	
January 12. . . .	17,262,000
July 1. . . .	17,899,000
1837.	
January 10. . . .	17,422,000
June 27. . . .	18,202,000

Notes circulated in England and Wales by Private Banks, and by Joint-Stock Banks.

	£
1836.	
March 26. . . .	11,447,919
June 25. . . .	12,202,196
September 24. . .	11,733,945
December 31. . .	12,011,697
1837.	
April 1. . . .	11,031,063
July 1. . . .	10,872,437
September 30. . .	10,142,049
December 30. . . .	10,870,135

Money, on the highest theological authority, is the root of all evil. It so complicates the relations of life, as to baffle the simple exertions of industry in one life; and, it is the immediate cause of three-fourths of human crimes. It is desirable for interchange; but, for this convenience, its miseries ought not to be suffered. The sabbatical year of Moses is a remedy, and, though 50 years is a short period for regeneration, yet it is, perhaps, a *mean*; for money, and all its artifices, have a *limit*, and, if left to its own operations, 50 years, or two lives, generally adjusts discrepancies, and turns round the wheel of avarice, wealth, and poverty!

Unwieldy capital is the rage of this generation. It is useless to the possessor, and it creates great consequent poverty. We have individuals, who, by thrifty habits, have capitals of several millions, and millionaires are numerous; while tens of thousands find every shilling absorbed by the accumulators and their indirect operations. Some realize on their stock 50,000*l.* a year, and others realize land to the amount of 200,000*l* or 300,000*l.* The justification is, the trite maxim that every man should do as he will with his own. All states have, on this principle, had their useless capitals; but what is now become of them and their own capital? Live, and let live, is the language of wisdom.

Our career of circulation and display of wealth is not yet above a century old. We were so poor in the reign of Charles II., that Louis XIV. pensioned most of our public men. At the Revolution, the revenue had been got up to 2 millions; but, in the reign of Anne, circulation, colonies, commerce, the banking system, &c., raised the monied character till the accession of George III.

The nations that have run the career of increased transactions, credits, and fictitious capital, till they have arrived at a limit, have been Phœnicia, Tyre, Carthage, Venice, the Hanse Towns, Genoa, and Holland. For the time, they displayed the indefinite capital of credit, and its double in debts. The real money and property were unchanged; but enterprize begat general debt, and then, for every debtor there must be a creditor. Such a system is the temporary prosperity of nations, and its period has usually been two centuries.

What a lesson, in proof of the evanescent and equivocal character of wealth, are the Histories of Phœnicia, Tyre, Carthage, the Hanse Towns, Venice, Genoa, Holland, &c. and even our own East India Company, our West India interests, &c. &c. We do not yet understand that wealth is individual, local, and relative, not national or absolute; and that, although individuals may be enriched as to other individuals, yet the average condition of the country remains as before. Money may be cheapened, circulation may be enlarged, and the creation of debts facilitated by transactions; but the bubble burts the moment it is necessary to balance accounts.

It seems agreed, that no assumption of pretended knowledge ever wrought such frightful evils as the abstractions called Political Economy. It is an assumed science of society, in the hands of persons utterly ignorant of the details and workings of society; and it consists of specious theories, always practically false, relative to the pursuits and fortunes of men, imagined by closet speculators, who know nothing of the real business of life. In general, too, the basest servility to wealth and power distinguishes the school; and, to assist the rich in oppressing the poor, with effect and plausibility, appears to be the main object of its dogmas.

At Bornou, narrow strips of cloth are used instead of coin.—*Denham.*

The English residents in France and Belgium draw for 5 millions sterling.

The Emperor of Morocco's strong private treasury at Mequinez, is believed to contain above 12 millions sterling of bullion, coin, and jewels. His revenue is 3-4ths of a million, and public expenditure less than a quarter.

The Monte di Pieton, at Rome, is a public pawning-establishment, which lends on pledges under 30 crowns, free of interest, and above, at 2 per cent. redeemable within 2 years. Paris has a similar establishment; but the needy, in London, are a prey to usurious pawnbrokers, who charge 15 and 20 per cent. with other exactions.

The public debts of France are 192 millions sterl., with 10½ charges, and increasing.

The debt of Holland is 1100 millions of florins, charge 34 millions.

The revenues of Austria are 14½ millions, and two-thirds are spent on a peace-establishment of 286,000 men.

The revenue of Belgium is 3½ millions, half of which is spent on the army.

The revenues of Brazil are 2½ millions, and its exports 5 millions.

The revenues of Naples are 3½ millions sterling, and the debt 20 millions.

The revenues of Prussia are 8 millions, and the debt 29 millions.

The revenues of Russia are 16 millions, and the debt 50.—*For other Estimates, see* BALBI'S TABLES—ART. *Geography.*

The capital of the East India Company is now 6 millions, on which the proprietors receive 10½ per cent.

A French writer estimates the debts of all the European governments at 37,250 millions of francs, or 1500 millions sterling; and, the specie to sustain these debts at only 5155 millions of francs, or 200 millions sterling. He takes the specie of France to be double that of Great Britain, or as 89 millions sterling to 44; and that of the rest of Europe at 67 millions sterling. He then estimates the obligations of companies, bank-notes, &c. at other 20,000 millions francs, or 800 millions sterling; so that 2300 millions sterling of obligations are arrayed against 200 of specie, or 11½ to 1. In Great Britain, the debt is 20 times the specie; in France, the debt is only double the specie. In Hol-

land, the debt is 12¼ times the specie; and, in Spain, as 9 to 1. The debts of France, Holland, and Spain, are taken at 4000 millions francs, or 160 millions sterling each.

Since money is the basis of all transactions, a man borrows at some rate of interest, to gain a higher rate by some enterprise, in which he also combines his ingenuity and industry. Interest ought, therefore, to be less than profits, or the industry is lost; and, since hope is greater than reality, and many enterprises fail, so interest ought to be greatly less than average profits.

The insidious character of usury is evident, from the fact that 5 per cent. doubles a capital lent in 14 years; trebles it in 21, and quadruples it in 28. Ten per cent. doubles it in 7 years, trebles it within 11, quadruples it in 14, and returns 8 times the sum lent in 28 years! No trade operates in this way, for a nominal profit of 20 per cent. in one year, with reductions for wear and tear, bad debts, fluctuations, waste stock, &c. in 14 years, silently reduce it to 10 per cent.; and there are few enterprises now, in Britain, which present the prospect even of 20 per cent.

The most cruel of all usury is, that which is legalized by pawnbrokers against poverty! They are allowed to average 15 per cent. on the necessitous, and without risk!

Previous to the passing of the usury laws by Henry VIII., the extortions of usurers led to continued disturbances and massacres of Jews and others. Since that time, the fixed value of money afforded free scope to industry, and the successive reductions with the severity of the law were the means which raised the commerce of England to its unparalleled extent. The usury laws are, in fact, the basis of credit, and the bulwark of our commercial system.

On the 26th February, 1797, the Pitt administration, to extend indefinitely the circulation, for the wild objects of the war, availed itself of an alarm, created by the landing of 1000 French troops in Wales, to issue an order in council, directing the Bank of England no longer to pay *cash* for its notes! This gave a power of indefinite and irresponsible creation, and enabled the ministry to raise loans and carry on the government, by a waste of money without example.

After 10 years, 229,100*l.* of 1*l.* and 2*l.* notes have not returned to the Bank, being a 24th of the previous circulation. Private bankers find that a similar proportion do not come in of their average circulation, on a series of years.

It is an indispensable feature of a sound banking and paper system, that security should be deposited with the goverment, for all issues of paper-money; and, also, an essential regulation that all issuers of promissory-notes, and drawers of bills, should, under criminal penalty, express the special consideration for which they are drawn.

In the United States, as well as in England, it is unlawful to take more than the INTEREST allowed by law; and money is limited in interest, owing to *the variable character of securities*, for the protection of the needy borrower. No profits of trade could accrue, nor any credit exist, if the interest of money were unrestrained on *commercial securities*. The power of a borrower to give any required interest, on such securities, would render it unsafe to give credit to any person in trade.

A party of political economists, however, thrust a clause into the Bank Bill, to allow usurers on short bills to take above 5 per cent., and the pernicious consequence is appearing in every branch of trade.

Rises or falls in the funds are governed entirely by supply or demand at the moment; or, by speculations on the probability of supply or demand. A rise may attend a low state of trade, from capital not being otherwise required, or a fall from improved trade. Prices are also affected by the relative strength of the two parties of *Bulls* and *Bears*, without any reference whatever to public events. It is with the stocks as with other commodities.

The stock-brokers and jobbers about the Stock Exchange are themselves proprietors of 15 or 16 millions; and it is their speculations which influence the prices. They are also engaged in *time bargains*, often for 40 or 50 millions, on which they may pay differences or deliver stock. Real buyers or real sellers are met by these jobbers, so that no effect on prices arises from real transactions, and the whole is a contest between the *bulls*, who speculate on a rise, and the *bears*, on a fall.

The 3 per cents. were, on Dec. 10, 1752, at 106⅝, and on Sept. 20, 1797, at 47⅞. After the panic, in February, 1826, consols fell from 83 to 74⅛, and exchequer-bills from 10 premium to 22 discount.

From 1690 to 1821 inclusive, the bullion furnished by the Mexican mines amounted, in round numbers, to about 400 millions of pounds sterling, of which the gold was somewhat more than 1-20th.

In SILVER, the proportion of silver to gross weight is 925 in 1000, in coins of England; 900 of France; 833 and 500 of Austria; 875 to 688 of Denmark; 813 in Spain; 750 of Portugal; of Rome 916⅔; of the United States 903; of Naples 833⅓; of the Netherlands 941 to 583; of Russia and Prussia 750; of Saxony 823; of Sweden and Switzerland 878; of Tuscany 917; and of Turkey 802 and 550.

French money is one-tenth alloy, so that the claim in exchange is nine-tenths of the weight, or 0·9. In English gold coin the alloy is 0·083; so that the claim is 0·917. An English sovereign weighs 7·980855, and is, therefore, in pure gold as 1 to 0·917; *i. e.* 7·318444035 is the claim. Then the French Napoleon, or Louis of 20 francs, weighs 6·45161 grains, from which one-tenth gives 5·806449 pure gold; that is, the 2 coins are as 5·8, &c. to 7·31, &c., or as to francs as 20 to 25·2079, the fractions being usually reckoned in *sous* of 20 to the franc; and, truly, 25 francs 4 sous 15·8 centimes. It is

commonly 25 francs, and 6, 7, and 8 sous, and 1 sous is taken by the broker from the published rate.

The present circulation of specie, in France, is estimated by French authorities at 3583 millions of francs, or 150 millions sterling, and the great abundance in circulation warrants the assertion. That of England was not 20 millions before the late alarming exports of specie and bullion.

The Russian mines in the Urals, according to Marshall, yielded in ten late years 65,330 lbs. of gold, 412,246 of silver, and 6067 of platina from Serpentine rocks, and a platina coinage has been established.

It has been reckoned that there exists, among men, 10 millions of lbs. weight of gold.

Gold, in 1813, was 110*s.* per oz. in England, and silver 6*s.* 11*d.* They were, in 1834, 77*s.* 10½*d.*, and 5*s.* *i. e.* as 1 to 15·6 nearly.

Juries are empowered to allow interest on debts, or damages as interest.

In consequence of the system of credit, the following, at the time of the panic, were averages of the mutual obligations of the people, one to another, or ultimately of nine-tenths to a tenth.

	millions.
500 Corporations had borrowed an average of about 30,000*l.* ..	15
300 Towns ditto, 20,000*l.* each......	6
300 Ditto, 10,000*l.*	3
14,000 Parishes, 3000*l.*	42
25,000 Miles of Roads, 280*l.* each......	7
2,500 Miles of Canals, 400*l.* each	1
400 Mines, 5000*l* each	1
50 Docks and Harbours, 20,000*l.* ..	1
500 Bridges, 2000*l.* each	1
50 Railways, 20,000*l.* each	1
500 Hospitals, &c. 1000*l.* each	½
Half a million houses were mortgaged at 300*l.*	150
One million at 200*l.*....................	200
Half a million at 500*l.*	250
24 Million acres, at 20*l.* per acre ..	480
12 Millions, at 10*l.* per acre	120
50,000 Traders, Manufacturers, &c. in debt, 5000*l.* each	250
50,000 Ditto, 2000*l.*	100
50,000 Ditto, 500*l.*	25
50,000 Ditto, 300*l.*	15
One million of families, 500*l.* each	500
One ditto, 300*l.* each	300
10,000 Ships owed 2000*l.* each	20
West India Property	50
Sundry unclassed property.............	50
Total millions	2744

Over and above the public debt of 800 millions!

On the run of articles of housekeeping at Fontainbleau, the *saving* averages 50 per cent.; that is, a man may live in that beautiful country better on 150*l.* a year, than in England on 300*l.* In the Norman islands, the difference is even greater.

The first book of Principles of Political Economy, was the treatise of North, in 1691, entitled "Discourses on Trade." Nothing of importance appeared in England from that time till the publication of Steuart's Principles of Political Economy, which was superceded by Smith's Wealth of Nations. Political Economy was first treated as a science by the French "Economists," at the head of whom was Quesny. In 1758, he published his Tableau Economique, et Maximes Générales.

The true foundations of a science of Political Economy would be in inductions from the History of the Rise, Duration, and Fall of Nations; but, unhappily, it is more easy to raise a pretended science on abstract notions and crude scholastic assumptions, by men who never had a single transaction of business.

Industry and enterprise seeking capital, is the basis of all prosperity and production. It is the working bees seeking the spare means of the drones, and becoming their slaves in the payment of interest.

Capital is never freely directed by capitalists, but only to such objects as the capitalist understands. Hence, little capital is directed to complex trades, or to any trade, till the simplest sources of profit are supplied; and, hence, the mischiefs of opposing public securities to the wants of trade and industry.

It is one of the crudities of the Political Economists to suppose, that because a man, as merchant or manufacturer, trades, or gives employment to the amount of 100,000*l.* a year, that he is therefore worth 100,000*l.* It may happen to be so; but, in 99 cases in 100, it is not so; and their arguments about capital, &c. are founded on the exception.

If the first merchant or manufacturer must be a capitalist, there would be neither one nor the other. Land-proprietors do not become traders, nor do misers; but both yield some of their means to men of character, for the intelligible profit of interest. As it is with 1, so it is with 100; and then a hundred men who return 100 000*l.* per annum each, and give each other indefinite credit, constitute a great commercial community. Credit is the basis, credit the instrument, credit the preserver, and if lost, or readily shook, the fabric tumbles like a card-house. The effect, while it lasts, is that of capital, and capital may in degree be generated by profits; but even this is efficient, only while the fabric of credit lasts.

It appears, in fact, that owing to the fluctuation of prices in American articles, exported in 1836, as compared with 1838, that fewer goods were exported in 1836 for more money than in 1838, by 15 per cent. Cottons alone, in 1836, were about 445 millions of lbs. weight; but, in 1838, were 549 millions of lbs., which were exported at above 2 millions less sterling value than the less quantity in 1836.

The monetary system of England is in a peculiar condition. A debt of *fixed* value exists, demanding a perennial *fixed* amount of interest. When incurred, the obligation bore a certain ratio to the public property,

and the interest a certain ratio to the national income. In 1820, the assets were to the debt as 3 or 4 to 1; and the income was to the interest as 7 or 8 to 1; but the reduction of values has lowered one 2 to 1, and the fall in market prices, the latter as 3 or 4 to 1. Thus, a redeemable assessment of 6s. 8d. in the pound, on all property, in 1820, would have liquidated the debt; but now 13s. 4d. would not suffice. From these dilemmas, there seems no obvious escape, and they constitute the *limits* of public prosperity.

LAND AND AGRICULTURE.

The Trigonometrical Survey of England gives 32,332,400 acres for the surface, and must be correct; but, the aggregate of the Parish Returns is but 31,770,616. The square miles in the survey are 50,515.

The length between Dunmore and Clifton is 1,036,337 feet, as 2.8394 degrees of latitude, which is 364,933 feet, or 60.822 fathoms, to a degree, in lat. 52° 2′ 22″. In 51° 2′ 54″ it is 60,884, and in 52° 50′ 29″ 60,766 fathoms.

Couling states the land of the United Kingdom as under,

	Cultivated.	Uncul.	Useless.
England..	25,632,000	3,454,000	3,256,400
Wales ..	3,117,000	530,000	1,105,000
Scotland .	5,265,000	5,950,000	8,523,930
Ireland ..	12,125,280	4,900,000	2,416,664
Islands ..	283,690	166,000	569,469

Total cultivated 46,522,970; uncultivated 15,000,000; useless 15,871,463. Superfices 77,394,433.

The arable and garden are 19 millions, and the pasture 27½ millions.

This, at 5 millions of families in the United Kingdom, gives above 9 acres each, or nearly 4 arable and 5½ pasture, *i. e.* double the quantity usually demanded for a family.

Becke estimates the landed properties at 200,000, between 100,000*l.* and 2*l.* per ann.

Marshall estimates the annual produce of the soil of Great Britain to be 160 millions; and this he distributes as under:

Subsistence of producers..........	25
Rentals	40
Wages of servants	4½
Day-labourers	26¼
Parochial assessments............	5¾
Tithes	4
Artisans and mechanics	12
Profits for luxuries, &c.	43½
	160
Imports in exchange for exports..	45

Which 205 millions constitute the sum total of our profitable transactions, however they may be variegated and multiplied, by wholesale and retail dealing, or disguised by artifices of banking, fictions of money, &c.

The Emigration Committee estimated the cultivated land of Great Britain at only 34,254,000 acres, and the annual produce at 150 millions. They also estimated the uncultivated land at 22,579,330 acres.

The same committee state the cultivated land of Ireland at 14,460,300 acres, and the uncultivated at 5,340,736 acres.

Other 15 millions are capable of cultivation, especially by spade husbandry, and nearly 16 are barren rocks and waste.

The whole contains 120,930 square miles, and is equal to a square of 347¾ miles on each side. England alone contains 50,539 square miles, the side of which is 224·8 miles.

By the returns of the property-tax in 1814-15, the 25¼ millions of acres cultivated in England were given in at 31,905,866*l.* of rental, or 24*s.* per acre.

The 3¼ millions acres of Wales at 1,910,888*l.* rental, or 12*s.* 4*d.*

And the 5½ millions in Scotland were returned at 4,849,593*l.*, or 18*s.* 6*d.* of rental per acre.

The whole rental was returned 37,066,347*l.* for 34 millions of acres, or about 1*l.* 2*s.* per acre on the average.

The 12¼ millions in Ireland, &c., at the same value, would be about 14 millions of annual rental.

Making the land of the United Kingdom, in 1814 15, worth a rental of 51,666,347*l.*

It was for taxation, no doubt, made 12½ per cent. below its true value, so that the true rental was probably 60 millions.

But the panic, and the withdrawal of the efficient local currency, have reduced rent from 20 to 25 per cent., so that the present rentals may, perhaps, be correctly estimated at 20*s.* per acre, or 46½ millions for the United Kingdom.

The 46½ millions of acres, letting at 20*s.* and at 25 years purchase, are worth 1262½ millions, either to landlords or mortgagees.

Taken at a net average produce of 3½ rents, the land yields 162¾ millions of annual profits to the public stock.

Then, as the annual produce of land is now on the average about 3½ the rental, it may be taken at 162¾ millions on the average of the last ten years. But the panic has so reduced prices, that 3 rentals is, perhaps, the true value for 2 or 3 years past; and, hence, farmers have no profits, and cannot employ labourers, or only at reduced wages.

In the age of the Plantagenets, Rents were to Produce as 1 to 30; at the Revolution 1 to 12; under the Funding System they rose as 1 to 7. In the paper-money times they became 1 to 5 and 4, and under the fall of markets have, since 1830, been as 3·5, and 3 to 1. Valuers usually take it as 1 to 4, or 1 to 5, according to the value of land; on good land, 1 portion is allowed for rent, 2 for labour, manure, seed, &c., and 1 for the occupier; but, on poor soils, 3 is allowed for labour, &c.

If good land yields 4*l.* of produce, 1*l.* is taken by the landlord; but, if the produce is 3*l.*, the landlord's share is 15*s.*; but, if labour, &c. is 2*l.*, then but 5*s.* remains to the tenant; while, if the landlord takes his 20*s.*, nothing remains to the occupier.

Arthur Young had the great merit of drawing public attention to the capabilities

of landed improvements, about 1770. His Tours, Farmers' Kalendar, Annals, &c. aroused the attention of proprietary; societies were, in consequence, originated, and vast improvements made in cultivation and in stock. ROBERT BAKEWELL proved, in 1780, that we might even controul nature in the forms of animals; and many machinists shewed that mechanical power might be applied in threshing, winnowing, dibbling, &c., while even the ancient plough underwent many great improvements. Draining was reduced to a science by ELKINGTON, and road-making by M'ADAM. In 1790, Sir JOHN SINCLAIR was placed at the head of a Board of Agriculture; and, all that zeal could do, was done by him and others.

The ministers, in 1822, estimated the incomes of the whole population at from 250 to 280 millions; but it is now taken at 300.

Average land in England produces 25 bushels, weighing 60 lbs., per acre of wheat, or 48 lbs. of good flour, in all 1200 lbs. of flour, which produce 365 quartern-loaves to the acre. Then, as 365 quartern-loaves supply a family in bread and other flour, and there are $3\frac{1}{2}$ millions of families, this number of acres may be assigned to wheat.

The grain produce is on the average 3 quarters of wheat, 4 barley, and $4\frac{1}{2}$ of oats. A bushel of wheat weighs from 57 to 62 lbs. and it yields 45 lbs. of flour for wheaten, and $48\frac{1}{2}$ for household bread.

Improved management has doubled the produce within a century. The average is 25 bushels to an acre; seed $2\frac{1}{2}$ bushels. Mr. Coke's estate in Norfolk, and the Isle of Wight, averages 35; seed 4 bushels. Garden-grounds round London produce from 200*l* to 400*l*. in crops per acre; and rent, 10*l*. to 20*l*.

An acre of good land (according to Middleton) yields, per day, 10 oz. of mutton and 8 of beef, or 228 lbs., and $182\frac{1}{2}$ per annum. Hence, if rent is 2*l*., and rates and expences 2*l*., mutton costs $4\frac{1}{2}$*d*. per lb., and beef $5\frac{1}{2}$*d*. to the grazier. A man, who consumes 2 lbs. of mutton per day, eats the produce of three acres, and of beef four acres, which three and four acres would produce 72 and 96 lbs. per day of potatoes, and 10 and $13\frac{1}{2}$ lbs. of wheat.

An acre of potatoes produces 250 bushels of 70 lbs. or 17,500 lbs., and taking one-half as nutritious, we have 8750 lbs. to the acre, or eight times the produce of wheat; so that an eighth of $3\frac{1}{2}$ millions of acres would feed the same number of inhabitants, or the same number of acres would feed eight times the number of people.

The land in grain cultivation is, on various authorities, about $7\frac{1}{2}$ millions of acres in England and Wales. In grasses and cattle crops $2\frac{1}{2}$ millions, in pasturage 17 millions, in gardens 50,000, in parks 250,000, in fallow 2 millions, in hedges, roads, and water-ways, 1 million, in commons and waste $5\frac{1}{2}$ millions.

Provisions are more abundant in populous countries than in those where the inhabitants are scanty, though the soil be the most fertile in the world, as in North and South America, Central Africa, &c.; for the produce of human food depends on human foresight and labour.

The *nutritive* matter in an acre of various grasses in lbs. is as under:

Poa aquatic (flower)	4945
Clover (seed)	4211
Festuca elatior (flower)......	3988
Festuca calamaria (flower) ..	3929
Holcus mollis (ditto)	2393
Bromus sterilis (ditto)	2340
Dactylis cynosuroides (ditto)	1898
Phalaris canariensis (ditto) ..	1876
Bromus multiflorus (ditto) ..	1755
Arundo colorato (ditto)......	1702

Other 30 species far less.—*Davy.*

In England, an acre in various produce for Man yields, in lbs. of food per annum, as under :—

	Per Ann.	Per Day.
Mangel Wurzel......	22,000	60
Parsnips	11,000	30
Cabbages............	10,700	30
Turnips	8,240	25
Potatoes	8,000	24
Apples..............	7,500	24
Carrots	7,000	21
Pears	5,000	15[illegible]
Onions	2,800	7[illegible]
Beans and Peas	2,000	5[illegible]
Plums, Cherries, &c.	2,000	5[illegible]
Oats	1,840	5
Barley	1,600	$4\frac{1}{3}$
Wheat..............	1,250	$3\frac{1}{3}$
Mutton (*Middleton*) ..	224	[illegible]
Beef................	186	[illegible]
Milk	2,900	7[illegible]
Butter	300	[illegible]
Cheese	200	[illegible]

An acre, in provisions for cattle, yields from 9 to 10,000 lbs. of vetches and cinquefoil, 7000 lbs. of grass, and 4000 of hay.

Good land, in the United States, produces fifty bushels of Indian corn.

Knight cultivates a variety of potatoe which yields 1000 bushels of 60 lbs. to the acre.

The average consumption of the British population per week is, or ought to be, a quartern loaf, ten ounces of butter, eight ounces of cheese, four lbs. of flesh, six lbs. of vegetables, one quart of milk, two quarts of beer, &c., half a lb. of sugar, two ounces of tea or coffee, half a lb. of candles, one bushel of coals, half a lb. of soap, and 1*s*. in sundries, costing, in 1832, about 8*s*. each, or 21*l*. per annum, besides house-rent, 2*l*. 10*s*., and 5*l* for clothing, in all, 28*l*. 10*s*. Five may live together for 100*l*., and yet we hear of board and education at 15 or 16 guineas, and of manufacturers, &c. getting but 6*d*. per day. 25*l*. for 24 millions of people, bespeaks an annual expenditure of 600 millions.

In the provinces, the quantity is not less per diem; but the proportions vary, and 24 millions in the United Kingdom demand an average 450 lbs. annually of various food per acre, from the 56 millions of cultivated acres, for the ordinary sustenance of the population.

London actually consumes, in oxen,

calves, and sheep, per Smithfield returns, 160 millions of lbs. per annum, independently of 3.7ths offal. This applies to about 4.5ths, or to 1,200,000 of the gross population, and is about 133 lbs. per annum to each. But pigs, fish, poultry, and game, make up an equal weight. Butter is 50 millions lbs., and cheese and eggs as much. The flour and salt in bread is 320 millions of lbs. and a fourth more is used for other purposes, with half as much more of all other grain. Vegetables and fruits are equal to flour. And sugar, tea, coffee, oranges, foreign fruits, &c. are equal to Smithfield. Hence the consumption of London, taking the population at 1,400,000, is as under :—

Smithfield Market	160 millions
The out-parishes	27
Pigs, fish, and poultry	160
The out-parishes	27
Butter, cheese, and eggs..	100
Milk 29 million quarts ..	58
Bread	320
Other flour..............	80
Other grain for man	100
Potatoes, vegetables, &c.	400
Sugar, coffee, &c.	160
Total lbs. per annum	1592 millions

Which, divided by 365 × 1·4 millions, is exactly 3 lbs. and 2 oz. per individual per day; which may be taken at 10 oz. for breakfast, 24 oz. for dinner, and 16 oz. for tea and supper. All independent of wine, spirits, drugs, horse-keep, &c. &c.

If, then, every acre is supposed to average 1000 lbs. of London food, the consumption requires above a million and a half acres, or above an acre for every individual, or 5 such counties as Hertfordshire.

Rye is the bread-corn of Russia, Germany, &c., and barley of Wales.

The United Kingdom has more land in meadow and pasturage than any country in Europe. As much as France and Denmark, and as Germany and Prussia, and as Russia and Italy; and ten times as much as Austria, as Naples and Sicily, and as Turkey in Europe; also 20 times as much as Spain.

There are 29 millions of cultivated or capable acres in England and Wales, 5½ in Scotland, and 13 in Ireland; in all 47½ millions; and, taking the families at 4 millions, nearly 12 acres to every family. Every acre will support a family on vegetable diet; but, in flesh and vegetables, 3 acres are required to live in plenty. The United Kingdom might, therefore, support 250 millions of inhabitants on vegetables, or 80 millions on flesh and vegetables, without resorting to the 30 millions of uncultivated soil.

Lauderdale calculated, that 9,000,000 of people, the supposed population of England, would require only 2,412,716 acres of land, on his plan of using only a vegetable diet. In that case, England would support 180 millions of people.

The estimated proportion of tillage and pasturage of the 40 English counties, in 1821 was as 168 pasture to 111 tillage. In Wales, the tillage to the pasture was taken as 1 to 3.

The tillage and pasture of England are now as 975 to 1369, and the woods and waste as 880. In Wales, the tillage, pasture, and waste are as 19, 22, and 13.

The coasts of England and Wales are officially considered as about 2000 miles, Scotland as 1100, and Ireland as 1300.

The difference of subsistence between the French and English appears by the fact, that in France the arable is to the pasture land as 50 to 13; but, in England, as 34 to 42.

All people divide themselves into four classes: husbandmen, traders, soldiers, and clergy. The Hindoo system peculiarly consists in fixing each for life.

Wheat weighs from 57 to 63 lbs. per bushel, and 13 lbs. of flour are produced from 14 lbs. of grain. The straw is double the weight of the grain. If an acre yield 30 bushels, at 60 lbs., the straw is 2 × 1800, and the whole 5400 lbs., with roots, &c. not less than 20 lbs. per square yard.

The weight of a bushel of barley is from 50 to 54 lbs., and the produce is 40 bushels.

Oats weigh from 36 to 44 lbs. per bushel, and an acre yields from 50 to 80 bushels; 14 lbs. of corn produce 8 lbs. of oatmeal.

The produce of beans is about 30 bushels. In the pods, peas yield from 30 to 40 sacks per acre.

Potatoes, in ordinary modes of cultivation, yield from 10 to 12 tons per acre. In Ireland, they get 82 barrels of 20 stone, or 22,960 lbs., *i. e.* about 10 tons.

Middleton estimates the arable land at 12 millions of acres. 3·8 in wheat, 0·9 in barley and rye, 3 in oats and beans, 1·2 in turnips, potatoes, &c., 1·3 in clover, and 0·8 fallow.

Macculloch makes the cultivated land of Scotland to be but 2½ of arable and 2½ pasture.

White crops are never sown in succession, but green or pulse crops are interposed. 1 for man, and 1 for beast, is the rule. The Norfolk, or 4-shift system, is turnips or potatoes; barley or wheat; clover, oats, then turnips, &c. over again. Other rotations are fallow, wheat, beans, oats; or tares, wheat, clover, oats, beans, wheat, fallow; or grass for 2 or 3 years, then ploughed and cultivated as above, and grass again.

The importation of wheat is rather an affair of commercial exchange, than of necessity. It averages less than half a million of quarters, or only one gallon per head on our entire population.

According to Arthur Young, the average prices of wheat, per quarter of 8 bushels, were,

	£	s.	d.
13th Century	1	2	9
14th ——	1	6	0
15th ——	0	12	0
16th ——	1	3	8
17th ——	1	18	2
18th ——	1	18	7

Cassava flour, touched by no insect, is the farinaceous food of man in South America.

Winter wheat is sown between September and November, and Spring in March and April. The seed is 2½ to 3 bushels per acre.

A defect of a tenth in the harvest operates a rise of 3-10ths in the market-prices of corn; and of a half, or 5-10ths, a rise of 45-10ths in the price.—*Davenant.*

The consumption of grain in the United Kingdom, is estimated at 48 millions of quarters, besides 8 or 9 reserved for seed.

After the great Plague of 1349, corn rose from 5*s.* 4*d.* per quarter to 11*s.* 9*d.*, owing to the derangements from general mortality. From 1444 to 1509, wheat averaged 6*s* the quarter, and labour 10*d.* a day.

Marshall estimates the selling price of grain at 60 millions per annum; of meat, at 60 millions; and of butter, cheese, wool, &c., at 40 millions. The wheat is taken as 16 millions quarters, and the grain at 20.

57 lbs. of wheat are equal to a Winchester bushel, and 59 lbs. to an imperial bushel; and the quantity of flour equal to an imperial quarter of 8 bushel, or 492 lbs. of wheat, is 392 lbs. The Winchester quarter was 64 gallons, and imperial is 66 of the same bushel, or about 3 per cent. more. Wheat is to flour as 472 to 392, or 59 to 49, so that if an imperial bushel of wheat is sent to a mill, 49 lbs. of flour is to be returned. Prices of wheat and flour ought to be inversely in that ratio.

In the 22 years last past, wheat averaged in Prussia 1*l.* 8*s.* 3¾*d.* per imperial quarter, varying 15 per cent. up and down. Their scheffel is 1½ the imperial bushel, and 5⅓ scheffels are an imperial quarter. In England, in 1837, the average was 2*l.* 16*s.*, or double; and, in 1838, 70*s.* or 2½ times more than in Prussia. In 550 weeks, from 1828 to 1838, the duty on import exceeded 40*s.* in 85 weeks, and it exceeded the Prussian average price in 300 weeks.

The wheat of the drier climate of France is worth 20 per cent. more than English. On an average of 16 years, in 26 places, it sold at 17·51 francs per hectolitre, or 40*s.* 1*d.* per English quarter. In October, 1836, the average, in France, was 39*s.*, and in England 48*s.*, which, with 20 per cent. inferior quality, would be 57*s.* 7*d.* Irish and Scotch wheat, 30 per cent. worse than French.

Wheat, in many places in England, is sold by weight, taking 62 lbs. to the bushel. When English white wheat fetches 59*s.* and red 57*s.*, Irish exported wheat fetches but 45*s.* or 42*s.*

The *average* size of farms, which was about 60 acres in 1760, and 75 acres in 1790, is now, for England and Wales, 225 acres, and in some counties 360! But the small farm-houses *are gone*, and the ancient rural population *dispersed* in manufactories, or living as pauper labourers. Then, manufactories being ruined by competition and over-production, plans of extensive emigration are now afloat! What a striking parallel to the case of the *Maremma di Roma!* In discussing these subjects, there is a mystification about increase of population. But, if our population is now 14,000,000, this, by the constant 156, gives 90,000 for the number of marriages necessary to sustain the population without emigration, or extra mortality. They, however, are 105,000, and the difference 15,000, by 3 8, is an excess of 57,000 per annum, which, in a generation of 41 years, would be an increase of 2⅓ millions. But if, owing to the decay of manufactories, and the size of farms, there is such an apparent excess of labour as to render it politic to transport 100,000 emigrants per annum, then, instead of any increase, we suffer an actual decrease of 43,000. It is the unwise monopoly of the usual means of living, that creates the excess of labour, and the destitution.

All the arguments in favour of large farms are invented by those who want greater rents; or have been written to please such persons. If 500 acres are to subsist but one family instead of ten, the single person can give, at least, double rent out of his ten-fold profits.

The objection to small farms arises from their want of means and capital to improve, but there is no improvement of which associated or parish funds may not put the smallest cultivator into easy possession, if wisely directed to this end. If the half million of married agricultural labourers, and the half million of married manufacturing labourers, had each their half acre, this would absorb half a million of acres, and enable them to produce as much food as 5 millions in grazing or tillage.

The farmers who employ labourers, that is, actual farmers in England, are 141,460; in Wales, 19,728; in Scotland, 25,887; in Ireland, 95,339. These numbers indicate an average respectively of farms of 227 acres, 241 acres, 195 acres, and 153 acres If other things concurred, Ireland would be the happier country.

A farm in England of 400 acres, let at 20*s.* per acre, will require, to cultivate it well, that the farmer should have a capital of 3000*l.* sterling; to consist in waggons, carts, wheel-barrows, ploughs, harrows, drills, horse-hoes, and other implements, and money; besides horses, cattle, pigs, &c. One hundred acres manured yearly, at 6*l.* per acre. Subsistence for himself, family, and servants; and farm-servants' wages for one year.

Such a farm ought to produce five rents, viz.:—

The landlord's rent	£400
Profit on capital employed	300
Expences of annual manuring	600
Expences of cultivating the crop, tithes, taxes, poor-rates, wear and tear of implements, &c.	700
	£2000

Agriculture never rises to perfection in a merely agricultural country. It requires the stimulus and support of manufactures and foreign trade.

Three labourers are required for every 100 acres of arable cultivation, besides weeders, &c.

Every 60 quarters of grain employs one extra hand; so that, a million employs 16,600 labourers more than pasture-land.

The returned number of houses, exempt from house-tax, as farms, is, for England and Wales, 139,000; but the number of occupiers in England, who employ labourers, are 141,460.

Many overgrown land proprietors, take rents in the value of corn. In 1827, it was abated 31 per cent.; and, in 1828, 26 per cent. In Scotland, it is received in the value of wool and sheep; and, in 1827, was abated 29½ per cent.; and, in 1828, 31 per cent.

Arthur Young estimated the cattle of all kinds, in England and Wales, at 2,850,000, in 1770. In 1834, they were, probably, half as many more, or 4¼ millions. Sheep were about five times as numerous, or about 21 millions; and pigs three times, or about 13 millions. Of horses, there were about 1½.

It is computed that there are, in England and Wales, above 5 millions of oxen, 32 millions of sheep, and about 1,825,000 horses, 1-5th of which are kept for pleasure.

The chief breeds of cattle in England are the short-horned, long-horned, and Devonshire, the Galloway, the Welsh, and the Highland. The principal breeds of sheep are the South-down, the Norfolk, the Leicestershire, the Welsh, the Cheviot, and the Merino.

Four sheep live on an acre of moderate land in the summer, and two in the winter.

A horse consumes the produce of 5 or 6 acres in oats and hay; and, in farming, every horse consumes 1-6th of what he cultivates. Hence, the million and a half of horses consume the produce of full 8 millions of acres.

The argali, or mountain-sheep, is believed to be the savage stock whence the domestic sheep is descended. It differs as much as the wild boar from the hog, being as high as the deer, with the habits and manners of the wild goat, and large twisted horns.

There are full 150 millions of sheep in Great Britain, France, Prussia, Austria, and Spain.

The annual produce of wool, in Great Britain, is about 83 million lbs.; but it is become of secondary value, owing to the superiority of Saxony wool for cloth-making.

A team of oxen ploughs 36 acres per ann. on the average.

The marsh lands of Kent, used for breeding sheep, and fattening cattle, are 82,000 acres, of which, Romney marsh is 44,000.

The agricultural horses are about 70,000, and the travelling and pleasure-horses 175,000, consuming the produce of 6¼ millions of land in grass and oats. Those in stage-coaches, in 1828, per tax-office, were 16,000, or about two horses for every three miles of turnpike-road. The race-horses were 790, and the mules 481. 1099 persons paid on 20 and upwards.

In five late years the French imported 81,104 horses, &c. from England.

Much rain is favourable only to crops on sandy, gravelly, or dry land. From 24 to 30 inches per ann. suit best the average of land, with the 3 or 5 of dew.

Clayey sub-soils and strata render a country subject to fevers and fogs. Strata which receive water have different results.

The heat necessary to productive vegetation is accumulated by the soil.

Black soils rise in the Sun from 65° to 88°. Chalky only from 65° to 69°. One colour is best.

Sandy soils yield turnips, potatoes, carrots, barley, peas, and grasses.

Gravelly soils, if dry, are warm, and yield barley, tares, peas, and oats. With much rain, potatoes. Very poor are fit only for woods.

Clay soils are expensive, but they produce beans, wheat, oats, clover, Swedish turnips, and crops of hay.

Peat soils, improved, yield oats, beans, root crops, and clovers.

Chalky soils yield peas, turnips, barley, clover, and wheat.

Alluvial soils, either marine or river, yield wheat, barley, oats, beans, and clover.

Loamey soils, (less tenacious than clay, and more so than sand,) a mixture of all, produce every kind of produce, but two white crops should not be taken in succession. The hazel loam is most fertile. Others are sandy, gravelly, clayey, chalky, or peaty.

Soils appear to have originated from the decomposition of rocks and strata; they are often found in an unaltered state upon the rocks whence they were derived, *i. e.* soft granite, or porcelain granite. This substance has three ingredients—quartz, feldspar, and mica. The quartz is almost pure silicious earth, in a crystalline form. The feldspar and mica are compound substances. Both contain silica, alumina, and oxide of iron; in the feldspar there is usually lime and potass; in the mica, lime and magnesia.

Feldspar of granite is usually an approach to white, with reddish shades. Quartz is grey, and transparent. Mica is grey, inclined to darkness. The feldspar and mica change, the quartz never. The feldspar becomes clay, the quartz becomes gritty sand, and the mica mingles with them.

Granite forms soil out of its three constituents—quartz, mica, and feldspar, by the action of air, carbonic acid, and water; for the quartz is silicious earth, the feldspar is lime and potash, and the mica lime and magnesia. As to the granite stone, feldspar is its cement as a fine clay; mica becomes sand, and quartz is the gravel or silicious sand. Soils are different proportions with oxides of iron, manganese, &c.

The soluble extract which sustains vegetation, is variably absorbed by farinaceous seeds and by the plants; hence, no seeds should be allowed to ripen for two crops on the same soil. Either the plants should be cut green in the second crop, or leguminous plants should intervene. Wheat and beans alternately, or wheat and tares; that is, one crop for man, and one for animals, suit

best. But, as different seeds and plants variously affect pabulum, experience has determined various rotations which render fallowing unnecessary. Turnips, barley, clover, and wheat, is the Norfolk rotation.

Loam is a mixture of clay, silicious sand, and carbonate of lime, and is the most fertile soil. Clay is alum, deprived of its sulphuric acid; sea-sand is the powder of flints; and carbonate of lime is the powder of marble, chalk, lime-stone, shells, bones, &c.

The dark-coloured vegetable soil, called *humus*, is produced by the decay of animal and vegetable substances, and is a compound of the four elements of oxygen, nitrogen, hydrogen, and carbon. Then the air (nitrogen and oxygen) and water, (hydrogen and oxygen) re-acting on the elements in the humus, produces a soluble compound, which taken up by the roots, generates the albumen of which vegetables are constituted. 100 parts of good humus are 20 carbonate of lime, 32 of sea-sand, 29 of alumina, and 11 of animal and vegetable remains.

The fundamental practices of good farming in England are, draining, weeding, and manuring. The soils are argillaceous, silicious, or calcareous, with vegetable remains; which, variously mingled, make up loamy, chalky, clayey, sandy, gravelly, and peaty soils.

When a granitic rock has been long exposed to the influence of air and water, the lime and potass in its constituent parts are acted upon by water or carbonic acid; and the oxide of iron, almost always in its least oxidated state, tends to combine with more oxygen; therefore, the feldspar decomposes, and likewise the mica, but the first most rapidly. The feldspar, which is the cement of the stone, forms a fine clay; the mica, partially decomposed, mixes with it as sand; and the undecomposed quartz appears as gravel, or sand of different degrees of fineness.

The absorbent power of water is a test of the goodness of soil. In a good soil, 1000 grains dried absorb from 10 to 20 grains in an hour; but a bad soil gains only from 3 to 8 grains.

Turnips grow in soil 11-12ths of sand, and other bulbs in 14-15ths of sand, but 19-20ths is unfit for vegetation.

Plants contain about 1-50th of the soil on which they grow.

Fertility is as the absorbent power of water on the soil.

The best modern composts is, for an acre, 4 gallons of oil or grease to 2 bushels of coarse salt, and 1 bushel of slacked lime to 50 lbs. of wood-ashes, mixed in 20 gallons of water, and incorporated with 40 or 50 bushels of mould. The cost is about 24*s*. All kinds of urine are also used.

Manure does not enter roots, but a result of it in a colourless fluid, and different plants have differently-formed absorbents or spongelets.

Salt mixed with dung, &c. is now the most approved manure for all cultivations. Two bushels are mingled with as much manure as is wanted for an acre.

Crusted bones, for the manure of light soils, are now imported, as profitable cargoes, from all parts of the world.

Bone manure requires from 25 to 50 bushels to the acre. Human bones are imported from Germany, ground in Yorkshire, and applied as manure to the land.

Animal manure is found to blast wheat, and so to affect pastures as to render flesh unwholesome.

Manure owes its stimulating power to salts of ammonia, or volatile alkali. Human soil affords three times as much as that of any animal.

Manure acts on the principle that plants require something more than pure water for their food, and actually imbibe elementary substances presented to their roots. Neither vegetable nor animals form, but imbibe the earths found in them.—*Davy*.

Marle is lime-stone and clay.

A large heap of sea-weed will decay, and leave only a small black residuum.

No soil will decrease in fertility under good management, in these climates. Duly apportioning meadow and pasture to arable land; manuring with crops ploughed in; Tullian husbandry and deep ploughing; fallow crops for fallows, and never taking two grain crops together, will sustain fertility.—*Sinclair*.

The best soils contain from 50 to 80 per cent. of silex.

Mr. Middleton found the soil of London-privies the best manure; and he inferred, that two loads per acre per annum would keep land in the highest state of production. Peat-ashes, coal-ashes, wood-ashes, malt-dust, soot, soap-makers' waste, were of little effect. Street-sweepings and night-soil best.

A clay sub-soil renders the surface too wet and cold, and a gravelly sub-soil drains it too quickly, and it is too dry. The surface-soil must be at least a foot deep, to be independent of sub-soil.

The best Holkham soil contains 8-9ths of sand, and the other 9th is 63 carbonate of lime, 15 silica, 11 alumina, 3 oxide of iron, 3 moisture, and 5 vegetable matter and salts.—*Davy*.

Soil is more or less absorbent as it loses weight by heat. The most absorbent are aluminous, or rich, in vegetable or animal matter.

Bulbous and tap-roots grow where sand predominates; but fibrous roots require more clay and firm substances.

Peat is generated by the decay of whole vegetable crops on the same spot, in succession. Peat bogs are formed by fallen trees, either cut or blown down, and left on the spot.

Evaporation from soils is equal to 4-5ths of the rain. Rivers carry 1-5th to the sea.

Mr. Bevan shews that the resistance, on a loose sandy road, is as 204; on a gravel road, 143; on a dry turf, 40; on a dirty turnpike, 39; and, on a clean M'Adamized turnpike, 30. In horses, as 7, 5, 1½, and 1.

Wells, dug on the sea-shore, above the high-water mark, to the depth of the low-

water mark, fill with fresh water as the tide ascends.

Fallowing does not enable the soil to absorb any thing beneficial from the atmosphere.—*Davy*.

The south-west of Scotland, Cumberland, part of Man, Wales, and Cornwall, are slates. Hereford and Monmouth is old red sand-stone. From Chester, to Lancashire and Cheltenham, is new red sand-stone. The London clay extends from Reading to Harwick and Sheppy.

The rental of land, at the close of the 17th century, before the debasement and increase of the currency by paper, was from 1*s*. 6*d*. to 2*s*. 6*d*. per acre. But land, being an article of the first necessity, and always in demand, rose with the amount of currency; and, since 1790, has risen to 25*s*., 30*s*., and 50*s*. per acre, or 9 or 10 times its price in 1690. Houses, also, have risen 4 or 5 times. In the mean time, surplus labour, from individual competition, has, in many instances, not risen at all; and, in no case above 50 to 75 per cent.

In Essex, and other counties, farms, let for 10*s*. an acre in 1790, have since been let for 45*s*. and 50*s*. In 1700, the same farms let at 2*s*. and 2*s*. 6*d*. In Staffordshire, &c., farms let at 8*s*. in 1790, have since paid 35*s*. and 40*s*. Treble the rent of 1790 is universal, and so, also, 8 and 10 times that of 1700.

Mr. Hamilton shows, that, on new enclosures, the cost per acre of the first crop of wheat is 6*l*. 14*s*. 6*d*., the produce of 18 bushels but 7*l*. 4*s*., and the tithe 14*s*. 6*d*.; leaving the farmer minus 4*s*. 10*d*. That a second crop of barley costs 3*l*. 16*s*., producing, for 25 bushels, 5*s*.; on which the tithe is 10*s*., leaving but 14*s*. profit. And that the third crop, potatoes, costs 12*l*. 11*s*. 2*d*., producing 100 bags at 3*s*., the tithe being 1*l*. 10*s*., leaving but 1*l*. 12*s*. 10*d*. on the three crops; and, without including rent or taxes, or risk of crops.

The pay of agricultural labourers was, in

1742	(per week)	6*s*.	1802	(per week)	9*s*.
1762	do.	7*s*.	1822	do.	8*s*.
1782	do.	8*s*.	1828	do.	7*s*.

Lord Teynham stated, that, in 1829, the wages of farming labour was reduced to 3*s*. per week; and, in some cases, to 1*s*. 10*d*.

In the reign of Richard I. a hide of land, 120 acres, was let for 20*s*., and a tax of 5*s*. per acre levied on 243,600 hides. An ox and a horse was 4*s*.; a sow 1*s*.; a sheep 10*d*.

It has been computed, that between 1793 and 1813, 60,000 farm-houses were pulled down for the anti-social purpose of letting the land to speculators.

In 1729, ***Flesh Meat*** was 29*s*. 8*d*. per cwt.; in 1780, was 32*s*. 6*d*.; in 1818, 59*s*.

In 1730, ***Bread*** was 1*d*. for 14½ oz.; in 1780, 1*d*. for 11⅝ oz.; in 1830, 1*d*. for 8 oz.

In 1730, ***Fresh Butter*** was 5*d*. per lb.; in 1780, 6*d*.; and, in 1830, 1*s*. 2*d*.

Cheese, in 1730, was 3¼*d*.; in 1790, 4*d*.; and, in 1818, 6*d*.

Peas, in 1729, were 4*s*.; in 1780, 7*s*. 6*d*.; and, in 1818, 10*s*. 9*d*. per bushel.

Flour, in 1790, was 43*s*. 4*d*.; in 1810, 88*s*.; and, in 1818, 65*s*. 11*d*.

Oatmeal, in 1730, was 4*s*. 6*d*.; in 1780, 5*s*. 3*d*.; and, in 1818, 13*s*. 6*d*.

In 1730, *Malt* was 29*s*. per quarter; in 1780, 31*s*. 1*d*.; and, in 1818, 83*s*. 9*d*.

Honey was used, instead of sugar, till the 15th century; and beverages were made of it, called Mead, Metheglin, Pigment, and Moret.

The price of provisions, in towns, is from 30 to 50 per cent. above that of the country, according to size.—*Allnutt*.

It is estimated that three agricultural families may support two artizan or trading families, in all the varieties of social employment, from the learned professions down to the blacksmith and carpenter, or as three agricultural to two of all other descriptions. But, by the returns of 1821, the entire agricultural population of Great Britain were 978,656 families employed in agriculture, including agricultural trades, to the number of 50,000: while the dealers and traders were 415,507; the manufacturers 924,432, and the unproductive families, who lived on the others, were 612,488, making the proportions 9 to 20 instead of 9 to 6 or 3 to 2. Hence, 1,400,000 families, or half the population, are in an artificial state, depending on exports and imports, on fashion, shifts, crimes, and contingencies.

A colony of 100 agricultural families ought, in due proportion, to consist of 66 of other classes, as, one priest, two lawyers, four medical men, four school-masters, six tailors, eight carpenters, five smiths, three braziers, two cabinet-makers, four brewers, &c., fourteen manufacturers, ten traders or interchangers, and three clerks or accountants; and, as it is with a colony, so it ought to be in nations, while the annual gains of each ought to be nearly equal, to make them happy.

To protect high rents, a tax on foreign corn was imposed in 1814 and 1828. It had, of course, no connection with agriculture, or the interest of tenants; but was, in every sense, *a landlord's tax*, in aid of lands mortgaged at more interest than the lands could pay, at an unprotected price of produce.

When corn, in our markets, is 73*s*. per quarter, it is subject, on importation, to a duty of 1*s*.; then, by a scale, the duty is raised as the price lowers; thus, from 66*s*. to 67*s*. per quarter, the duty is 20*s*. 8*d*.; from 61*s*. to 62*s*., 25*s*. 8*d*.; from 56*s*. to 57*s*., 30*s*. 8*d*.; and, from 50*s*. to 51*s*., 36*s*. 8*d*.; so, as to force foreign corn to be dearer than English, without reckoning freight and charges.

Four able-bodied labourers can dig an acre, half-spit, in a week, and the labour is estimated at 12*s*. each, per week; add 2*s*. for two pints of strong beer per day, and the cost would be 56*s*., ploughing costs 20*s*., and the difference, 36*s*., would be more than compensated by 50 per cent. increase of produce, or about 54*s*. on the average of crops. The soils adapted are poor ones, cold clays, and woodlands, gravelly soils, and sandy loams.

The author of an excellent pamphlet who signs *Cincinnatus*, estimates the increase, from digging, as 48 bushels to 27, 25, or 20, and a profit, per acre, of 4*l.* 15*s.* at least, taking the digging at 3*l.*, rent 1*l.*, 3 bushels of seed at 18*s.*, 12 loads of manure 2*l.* 8*s.*, and other expences to sale at 1*l.* 15*s.* For a crop of beans, the seed is 4 bushels, and the produce 48, at a lower price, or 1*l.* per acre. In potatoes, he reckons 16 bushels of seed for 320 of produce, and a third more manure, leaving a profit of 3*l.* 16*s.* He says, on good land and deeper digging, the produce may be 500.

A plough cuts a slice with the coulter, lifts by the share, and turns it over by the mould-board. It resembles digging, when well performed on a good soil. When not in lands or ridges, the mould-board is shifted in going back, and the plough is called *turn-wrist*.

Ploughing, digging, hoeing, &c. merely serve to expose the elements of the soil to the re-action of the elements of the atmosphere.

In Europe, generally, the laws of landed property are founded on the assumption of conquest by a chieftain, who distributed the whole as property to his followers, as FEUDAL VASSALS, in contempt of the prior natural rights of the original inhabitants. The feudal lords, having large tracts, took rents in kind, and not a 50th of the produce; but when the trading interests became landlords, and land an object of speculation, currency was exacted, and more and more, till the purchasers claimed a tenth, fifth, and even a fourth and third of the produce for mere rent!

In Cornwall, 100 acres let for 150*l.*; rates are 30*l.*; labour 200*l.*; seed 84*l.*; horses, &c. 151*l.*; taxes 19*l.* 7*s.* 6*d.*; tithes 15*l.*; produce 779*l.*, or five rents. In Yorkshire, rent is 150*l.*; rates 33*l.* 15*s.*; labour 178*l.* 13*s.* 8*d.*; seed 86*l.* 5*s.*; manure 35*l.* 4*s.*; horses, &c. 116*l.* 10*s.*; taxes 15*l.* 12*s.* 6*d.*; tithes 65*l.* 17*s.* 6*d.*; produce 718*l.* 7*s.*, or nearly five rents.

In arable cultivation, every acre of land costs the farmer from 7*l.* to 8*l.*, and it yields from 8*l.* to 9*l.*, at usual market-price, after all expences. Pasture-land costs less, and yield less.

The Fens, in Cambridgeshire, &c. amount to 350,000 acres, and are an extension of the gulf called the Wash. The tract has been drained by canals, and latterly steam-engines have been applied with great success. It was a woody district 500 years ago, and the sea, which then rose, appears now to be on the retreat nearly on the whole eastern coast.

In 30 years, about 2000 INCLOSURE-BILLS have passed, at a cost, in fees, &c., of at least one million; by which 108,000 acres, out of 18 millions of waste in the United Kingdom, have been enclosed, at a cost of nearly 10*l.* per acre for fees and expenses of getting the bills.

Five millions of acres have been enclosed in the last 120 years, by about 4200 acts of parliament, at a cost of 10*l.* per acre, and about 1200 acres for each bill. In general, the interests of the poor are neglected, and these acts serve often to increase the monopoly of land.

A ten-horse steam-engine in the fens will drain 1000 acres in 20 days at a cost of 2*s.* 6*d.* per acre for coals.

Since 1770, the various expences of farming have risen, in England, 52 per cent.; and, in Scotland, 70 per cent. The expence of cultivating a farm of 100 acres, including rent, tithes, rates, and direct taxes, was, in 1790, about 410*l.* In 1803, about 550*l.* In 1813, about 772*l.*; and, in 1823, about 900*l.* The produce of good land is generally divided, one-third for rent, one-third for expences, and one-third for profit; but, for inferior land, rent is taken at one-fourth.

House-rent, in the United Kingdom, in forty years, from 1780 to 1825, was quadrupled; and, in 1825, in general, stood mortgaged for double the rental in 1780. If, in 1780, rent averaged 8*l.*, in 1825 it averaged 32*l.*, making a rental on 3 millions of houses of 96 millions, and a probable mortgage of 600 millions.

The rental of the 3 millions of houses in Great Britain, may now be taken at 24 millions; and, the value, at not less than 240 millions.

The million and a half of houses in Ireland, may be taken at a rental of 9 millions, and a value of 90.

Colonel Sykes takes the rental of the 605,097 new houses in Great Britain, built between 1820 and 1832, at 13,665,364*l.*

In England, building is carried on by individual speculators, with money obtained by successive mortgages of money-dealers on floor after floor. The hope of gain leads to an excess of houses, and the undue enlargement of all towns. In other countries, no such system is known; and, the capital to build or re-build can be supplied only by mortgage from the public treasury. The system was commenced, in London, about 1770, when Mary-le-bone, &c. was rapidly raised; since which period, it has enabled builders, without money, to double the size of London.

A cow yields 168 lbs. of butter per ann.; and, as London alone consumes 36 millions of lbs., it is supplied by 215,000 cows. Milk, at 9 quarts per cow, requires 9000 cows, or 224,000 cows for London only.

92,000 cows, for cheese, are kept in Cheshire; and, as many more in other counties for various cheese, at 3 cwts., or double butter, per cow. At 6 quarts per day, is about 450 lbs. in a year. Cheshire yields 11,500 tons, and hence must have 60,000 cows.

Cheshire cheese owes its quality to the excellence of the soil, to the size of the dairy-farms, and the great number of cows kept on them, and to the accurate system of the manufacture. Some dairy-farmers have from 3 to 400 cows, each yielding 8 quarts of milk; from which is made 1 lb. of cheese, or for every 16 ounces of milk one ounce of cheese, being the produce of a cow

per day. The cheeses, therefore, are very large, running from half cwt. to one and two cwt.; and single cheeses have been made five or six cwt. In making cheese, it is customary to put two cups of rennet to about 25 gallons of milk, at a heat of 100°, and the curd comes within two hours. Cheese is a very ancient product. It is mentioned in Job and in Samuel, and by Homer and Hippocrates.

A cow eats 100 lbs. of green food every 24 hours, and yields 5 quarts, or 10 lbs of milk.

Muriatic acid curdles milk better than rennet, and preserves it from mites.

In November, 1836, when fine flour in London was 60*s*. the sack of 280 lbs., the same weight sold in Paris at 30*s*. 3*d*.; in Cambray, at 28*s*. 3*d*., and at Soisson, 25*s*. 10*d*. or as 65 London to 28 Soisson. In Paris, the 4-lb. loaf was but 5*d*., and in London 9½*d*.

The produce of the land of Spain has been recently estimated at 90 millions sterling; of manufactures at 14 millions; mercantile profits at 5 millions; and house-rent at 8 millions. The State debts, of all kinds, are about 350 millions. The ecclesiastical property is valued at 72 millions, and the crown at 23.

Spain, like many other countries, is ruined by the ignorant meddling with nature. The selfish Spaniards, in Castile and Leon, to deprive the birds of shelter, have cut down all the trees, and, in consequence, no rain falls, and the whole country has become desert. It has been the same in the West India Islands. Clouds require the spiculæ of leaves to act on their electricity.

The Nile must rise 16 cubits to ensure its extent of fertility. In 1829, it rose to 26 instead of 22, by which 30,000 people were drowned, and immense property lost. During summer, on each side of the Nile, are rich fields of corn and rice, and such beautiful groves seeming to rise out of the watery plains, and to shade innumerable settlements in the Delta, amidst never-ending plantations of melons, and all kinds of garden vegetables, that, from the abundance of its produce, Egypt may be deemed the richest country in the world. But to strangers, and particularly to inhabitants of northern countries, where wholesome air and cleanliness are among the necessaries of life, Egypt is the most detestable region on the earth. On the retiring of the Nile, the country is one vast swamp. An atmosphere, impregnated with every putrid and offensive exhalation, stagnates like the filthy pools over which it broods. Then the harvest regularly begins, and ceases not till the waters return again. About the beginning of May, when intermitting fevers prevail, certain winds cover even the sands of the desert with the most disgusting vermin, in swarms of millions.

In Turkey, every cultivator is a proprietor.

In social importance, in population, agriculture, and productive industry, Yorkshire, Northumberland, and Durham, are about equal to Scotland.

In spite of disadvantages of climate, agriculture is conducted in Scotland on more scientific principles than in England; and the rapid improvements of late years are ascribed to the currency of 1*l*. notes, which the wily Scotch retained when they were stopt in England.

The rental of Scotland, about the period of the Union, was but 317,018*l*.; but, in 1812, it was 6,108,050*l*., money being five times *less valuable*, but improvements had increased it fourfold. The population was under one million; but, in 1831, it was 2¼ millions. Ships increased, too, from 215 to 3160; and the revenue obtained was, in 1822, forty times greater than in 1707; *i. e.* 110,694*l*. and 4,292,567*l*.

Till 1750, no peas, turnips, potatoes, or grass, were raised in Scotland, and no cattle fatted. Oats and barley alone were cultivated, and peat-turf was the fuel.

There are 19,944,209 English acres in Ireland, equal to 14½ per family of 5·6. The houses are 1,249,816, containing 1,385,066 families. In Kerry and Wicklow, there are 25 acres to a family; but, in Armagh, only 7½.

Irish lean cattle are sent to all the ports of the western coasts of England, Bristol channel, &c. to be fed by English graziers. Their fat cattle are slaughtered to victual the English ships of war and merchant-ships; their butter, tallow, and skins, are in great part exported; and the money arising from all these articles sent to absentees and others, for rent and tithes.

Under fair management in Ireland, a spade-square of potatoes weighs 19 lbs. per spade, or 108 barrels per acre, each barrel 252 lbs. or 36,000 lbs. to the acre, or 100 lbs. per day on an acre.—*Young*.

285 tons 11 cwt. of turnips were a single crop of turnips on an Irish acre in 1829.

An acre of potatoes, in Ireland, generally yields 82 barrels, of 20 stone, or 22,960 lbs.: and an acre of wheat yields four quarters of 460 lbs., or 1840 lbs; then, if wheat goes three times as far as potatoes, and is equal to 5520, the potatoe crop gives four times more subsistence than wheat.

The export of Irish butter is about 20,000 tons, and 120,000 barrels of beef; besides 130,000 barrels of pork, bacon, and hams. The linen is 20,000 boxes; in all, about 1,680,000 pieces of 25 yards, at 50*s*. per piece on the average. Of whiskey they make from five to six millions of gallons.

One hundred thousand Irish labourers visit England, from March till October, to perform agricultural labour on large farms, which, having engrossed small ones, leave tracts and parishes, without adequate local population.

Meath and Westmeath are the chief grazing districts, and Down, Armagh, Louth, Wicklow, and Wexford, the chief arable districts.

The Bogs are 2½ millions, and run from near Dublin, expanding to the Atlantic. The Bog of Allan is 65,000 acres, and 270 feet above the sea. One million and a half acres of flat red bog are susceptible of easy improvement, and other 1½ millions might be applied to plantations.

COLONIES.

Wars, treaties, and original colonization, have secured to Britain every desirable commercial position that political cupidity could desire. We have the Cape, Mauritius, Ceylon, Bombay, and Bengal; Demerara, the Mosquito shore, Jamaica, and the best West India Islands; Bahama, Bermuda, Nova Scotia, Newfoundland, the Canadas, Malta, Gibraltar, the Ionian Islands, besides New Holland, Van Diemen's Land, Sincare, and finally New Zealand—and yet we want more, to secure the coveted monopoly of commerce!

But, unhappily, short-sighted policy overreaches itself, and the competition of individuals oversteps, as an aggregate, all monetary power; hence, *State-Banks* in general are bankrupt, and amounts in paper are ten-fold greater than all means of genuine circulation, to keep pace with the paper accounts of a wild commerce.

Colonization takes place when a people, from bad government, cannot live at home; or, when a country finds another unused, whose climate enables it to cultivate peculiar produce. The latter is the foundation of the West India and tropical European colonies; and the former is the foundation of the colonies of Canada, Nova Scotia, and Albany.

Nature produces and reproduces from the same elements, but if the productions are carried away, exhaustion renders reproduction impossible. Consumption on the spot assures return of manure; but consumption, at 6000 miles distance, affords no returns beneficial to the soil. This, then, is the limit of colonial wealth and production. Egypt has poured out its grain for 5000 years, but the Nile works a constant miracle in renewing the soil.

The British Colonies amount in number to 40. Of these, there have been captured 11, ceded 4, obtained by settlement 25.

The following are the forty British Colonies, which have establishments of local governments, of from twelve to sixty persons, affording patronage to the British administration:

Albany.	New Brunswick.
Antigua.	Nova Scotia.
Bahamas.	Newfoundland.
Berbice.	New South Wales.
Barbadoes.	Norfolk Island.
Bengal.	Prince of Wales's I.
Bermuda.	Sierra Leone.
Bombay.	St. Christopher's.
Canada (Lower)	St. Helena.
Canada (Upper)	St. Lucia.
Cape of Good Hope.	St. Vincent.
Ceylon.	Ionian Islands.
Demerara.	Jamaica.
Dominica.	Madras.
Fernando Po.	Malta.
Gibraltar.	Tobago.
Grenada.	Trinidad.
Mauritius.	Tasmania.
Mountserrat.	Virgin Islands.
Nevis.	

The produce of these Colonies is sugar, rum, spices, coffee, indigo, rice, sago, some cotton and tobacco, vegetable-oils, some wine and wool, timber, flour, fruits, hemp, flax, &c. &c.

Colonies ought never to be thought of but to get rid of superfluous population. They add nothing to the wealth, and nothing to the strength of an empire. They are war-breeders.—*Cooper*.

The English Colonies have a governor, lieutenant-governor, president of council, speaker of the assembly, chief-justice, attorney and solicitor-general, admiralty-judge, marshal, collector of customs, &c., and it is for the patronage of these employments, by the ministry at home, that three out of four of all colonies are maintained.

Lower Canada has a general governor, a lieutenant-governor, a bishop of Quebec; governors of Quebec and Gaspé, 10 judges, 13 of an executive council, and 28 of a legislative council. But late events have changed these arrangements, and a new British constitution, or a new republican one, may be soon looked for.

Upper Canada has a lieutenant-governor, 7 executive council, and 19 legislative.

Jamaica, besides the usual functionaries of colonial government, has a bishop of that island; and the Bahamas a Court of Admiralty, and Stamp-office.

Bengal is governed by a governor-general of India, and 2 others of a supreme council; with 3 secretaries, 3 judges, a bishop, &c. &c. Madras, Bombay, St. Helena, the Cape, the Mauritius, Ceylon, and Prince of Wales Island, have similar establishments.

New South Wales has a governor, and council of 13, with 3 judges, attorney and solicitor-general.

The Governors of Ceylon and the Canadas have £10,000 a year; of each West India Island from 4 to £5000. Jamaica £7000. Of the Cape £7000, and the Island of Mauritius £8000; besides residences, perquisites, retiring allowances, &c. &c.

The British territories, in India, consist of about 90 fiscal and judicial subdivisions or provinces. Under the government of Bengal, there are 56; under the Madras presidency there are 22, in which the total population is 13,508,535.

The presidency of Bombay consists of ten provinces, besides Bombay, and a territory in Cutch.

Till the act of 1833, for renewing the Charter, the Company was commercial, with sovereign powers; but the commerce is now thrown open to vessels of certain dimensions, and the Company receive the territorial revenues to pay expences, and the interest of their capital and debt.

The capital of the East India Company is six millions, paying a dividend of 10½ per cent. £1000 stock gives one vote, and £10,000 four votes. Of 2000 proprietors, 1490 have one vote, 396 two, 69 three, and 48 four votes. The concerns are governed by twenty-four directors in committees, six of whom go out every April.

The revenues of the Company are the land rents, formerly assessed by the native princes, amounting to 8¼ millions, an opium monopoly which has yielded 2 millions, a salt monopoly 2¼ millions, customs nearly a million, and other items, making, in Bengal only, 14¾. At Madras, these items yield 5¼ millions; at Bombay 2¾; and, with other places, are altogether about £23,000,000.

Bengal is divided into 24 pergunnahs, each with its judge and magistrate, registrar, &c.

British India contains 1,100,000 square miles, and 120 millions of inhabitants. The Ryots pay 14 millions in rent to the government, and the whole revenue is 20 millions. 48 millions had, in 14 years, been drawn from India without return, and 30, 40, and 50 per cent. was often given for money to buy seed!

Cotton, indigo, and saltpetre, are the chief commercial products of India; gums, drugs, horns, and hides, ebony and ivory, are also exported from India to Europe; and, it trades with the East in cocoa-nuts, betel-nuts, grain, cloth, &c.

An Hindoo village consists of a chief inhabitant, or *Potail;* a *Curnan*, or registrar of produce; a *Talliar*, or constable; a *Totie*, or land-surveyor; a *Boundaryman;* a *Surveyor of Water-courses;* a *Brahman*, or priest; a *Schoolmaster*, an *Astrologer*, a *Smith*, a *Carpenter*, a *Potter*, a *Washerman*, a *Barber*, a *Cow-keeper*, a *Doctor*, a *Dancing-girl*, a *Musician*, and a *Poet*.

The salary of the Governor-General of Bengal is 244,181 rupees; and, of the other 3 members of council, is 293,017 rupees at 2s. 3d. There are residencies at Delhi, Lucknow, Gwalior, Magpore, Hyderabad, Poonah, Nepaul, and Indore; and agencies at Jagpore, Harowtee, Serowhee, Mhairwarra, Bundlecund, Mundlaiser, Bhopawar, Mahidpore, Baugur Oodeypore, Bhopaul, and Bahar.

The dynasties that have been conquered by the British arms, in India, had been only of short duration—scarcely one of them had been in existence above a century. Of this description were the Nabob of Bengal, Bahar, and Orixa; the Nabob of Arcot, Tippoo Saib, and the Paishwa. The natives had no other attachment to them than what arose from their possession of power. An immense population, calculated at 68 millions, inhabits those conquered provinces.

Towns and reputed Population :—

Benares	600,000	Poonah	110,000
Calcutta	550,000	Nagpoor	115,000
Madras	462,051	Baroda	100,000
Patna	312,000	Ahmedabad	100,000
Lucknow	200,000	Cashmere	150,000
Hyderabad	200,000	Farruckabad	70,000
Dacca	180,000	Mirzapoor	60,000
Bombay	180,000	Agra	60,000
Surat	160,000	Bareilly	66,000
Delhi	150,000	Aurungabad	60,000
Moorsheda-bad	150,000	Burdwan	54,000
		Bangalore	50,000

The native army of the East India Company, disciplined in European tactics, is about 150,000 cavalry and infantry, spread over 500,000 square miles of Hindoostan, or thrice the surface of the United Kingdom. Their formation took place in 1757. They are usually called sepoys, and are light and short.

The Epochs of the British Dominion, in India, are as under :—

Two Charters, granted	1600 and 1609
Mogul's Firman, to permit four Factories	1612
Fort St. George built	1641
Bombay occupied	1668
Fort William built	1698
Calcutta taken by Suraja Dowla	1756
——— and Hoogly retaken by Watson and Clive	1757
Battle of Passy, between Clive and Suraja Dowla - June 23	1757
The Great Mogul, Shah Alum, defeated 1760 and	1761
Lord Clive, Governor-General	1765
War with the Nizam and Hyder Ali	1767
Warren Hastings, Governor-General	1772
Death of Hyder Ali	1782
Tippoo Saib, his Son, makes war	1783
Pitt's Board of Controul Bill	1784
Marquis Wellesley, Governor-General	1798
Seringapatam taken	1799
Battle of Assye	1803

Hamilton calculates the area of India at 1,280,000 British miles, and estimates that the British possessions occupy 553,000 square miles, or 4-10ths. British political influence, however, embraces the whole indiscriminately.

Ceylon has 6786 Europeans, and a million and a quarter of natives, besides 27,000 blacks.

The Mauritius has nearly 9000 Europeans, 16,000 Creoles, and 68,600 blacks.

The novelties of East Indian scenery are,—the palm and banyan trees, the elephants, the naked Hindoos, and the idolatries, festivals, and processions, with brilliant skies.

The government of the East India Company is comparatively just and equal, but the taxation is heavy, and some of the taxes very objectionable. The fortunes made by Europeans are spent out of India; Indian trade and manufactures have been overwhelmed by English machinery; and the emoluments of many native servants, under the old governments, are swallowed up in the pay of one English collector. These are causes of dissatisfaction among the natives.

Besides the Bengal produce of indigo, great quantities are exported from Madras, Java, Manilla, and South America. Fair profits require that it should sell at 9s. or 10s per lb. in London.

The Ghauts are the high table-lands in the centre, or mountain passes.

The Punjub is the country watered by the five branches of the Indus.

The chief revenue of India is derived from a tax upon land, which is levied in different parts of India, in different proportions to the cultivators' profits, and by different officers. In many parts, one half the crop (the old and exorbitant Musselman tax)

is considered the standard; and this being levied in money, and fixed without regard to the state of the markets, is often very much more than the cultivator.

1-10th of the Indian population are Mahomedan; and 100th Christian. The rest are in tribes, clans, trades, and sects, much divided, and without any education, except in legends, mysteries, and absurd traditions.

The interior of New Holland is woody, but without timber-trees; there is far more barren than fertile land, a general want of water, and very few animals. Banks of rivulets and particular tracts are fine. Port Philip is a very promising district.

India comprises the Punjab, the Sikh, and the Rajpoot States, independent, and in alliance with England; Oude, Malwa, Sattara, Hydrabad, Mysore, and Travancore, &c. tributary to England; and the four British Presidences of Bengal, Madras, Bombay, and Agra. It lies between 8° and 36° of N. lat., 66° and 92° of E. lon.

Ameer or *Emir*, in Hindoostan, means a nobleman; *Aumeen*, a commissioner, and *Aumil*, a tax-gatherer; *Banyan*, or *Bice*, a dealer or farmer; *Bega*, the third of an acre; *Begum*, a princess. *Bungalow*, a country-house; *Choultry* or *Serai*, a public barn for travellers; *Chunam*, lime; *circar*, the chief man of business; *Coolies*, porters; *Coss*, 2 miles; *Crore*, 10 millions; *Cutwal*, the chief of police; *Deccan*, the south; *Dewan*, a place of assembly; *Droog*, a fortified hill; *Durbar*, a levee; *Faqueer*, a religious beggar; *Fermaun*, a royal order; *Ghee*, clarified butter; *Jaghire*, an assignment of land; *Jungle*, a wood; *Khan*, lord; *Killadar*, a governor; *Lac*, 100,000; *Maha*, great; *Caliyug*, the present epoch, is pronounced *Calyoogum*; *Moonshee*, a secretary; *Musnud*, a throne; *Nabob*, a viceroy; *Nair*, chief; *Nizam*, an adjuster; *Omrah*, a Mogul lord; *Pagoda*, a temple, or 8s.; *Palankeen*, a litter; *Pariar*, an outcast; *Peshwa*, a prime-minister; *Peon*, a foot-soldier; *Peshcush*, tribute; *Poteil*, chief inhabitant; *Pundit*, a learned Brahmin; *Purana*, ancient books; *Rajah*, a sovereign; *Rajipoot*, the son of a king; *Ranee*, a queen; *Rupee*, 2s. or 2s. 3d.; *Ryot*, a peasant or tenant; *Shaster*, a book of instruction; *Soucar*, a banker; *Subah*, a county; *Teep*, a note of hand; *Vakul*, a deputy; *Vedas*, the Brahmin scriptures; *Yogies*, fanatics; *Yug*, an age; *Zomindus*, a rent-collector; *Zenana*, the Harem.

From Bombay to Calcutta is 1300 miles; and, to Madras, 770. From Calcutta to Madras, 1030; to Delhi, 1060; to Patna, 400; to Benares, 565; to Poonah, 1200; to Surat, 1310; and, to Cape Comorin, 1231. From Madras to Seringapatam, 290; to Surat, 930; and, to Cape Comorin, 390. From Delhi to Agra is 115 miles; to Bombay, 965; and, to Cape Comorin, 1415.

The Company maintain botanical gardens at Muggat, Thannet, and Scharunpore; and it has mints and assay-offices at Calcutta, Benares, Furruckabad, and Saugore.

Besides the College of Fort William, at Calcutta, with professors and 54 pensioned students, it supports colleges at Bhaugulpore and Benares; with geological, mineralogical, zoological, and botanical agents liberally provided.

The College of Fort William costs the Company 139,637 rupees; public instruction 148,736; and roads, bridges, &c. 279,747 rupees, at 2s. each, or 8d. per pagoda; or 2s. 3d. per Bombay rupee.

The number of British-born subjects in India is not 100,000. The natives in British pay are nearly 250,000, artillery, cavalry, and infantry.

An estate in the best part of the colony of Demerara produces, on an average, 800 hogsheads of sugar, which turn out 14 cwt. nett each, and 60 thousand gallons of rum. An estate at Demerara, in an average part of the colony, produces on an average 200 hogsheads of sugar, and 17,000 gallons of rum.

But since the just manumission of slaves, all speculations about estates, formerly worked by slaves, are very vague and unsettled.

Population, Produce, and Imports and Exports of the British West Indies, previously to the Manumission of the Slaves.

	Whites.	Colored Free.	Late Slaves.	Sugar.	Coffee.	Rum.	Value of Exports to G. B.	Value of Imports from G. B.
				Cwts.	*Pounds.*	*Gallons.*	£	£
Antigua	2,000	3,000	30,000	169,000	.	160,000	270,000	115,000
Bahamas	4,200	3,000	9,300	.	82,500	.	21,000	59,000
Barbadoes	15,000	5,100	82,000	322,000	.	27,000	542,000	360,000
Berbice	550	1,150	21,300	122,000	1,585,000	220,000	371,000	74,000
Bermuda	3,900	1,740	4,600	.	.	.	4,000	60,000
Demerara	3,000	6,400	70,000	737,000	1,940,000	2,320,000	1,627,000	450,000
Dominica	850	3,600	15,400	56,000	613,000	63,000	150,000	16,000
Grenada	800	2,800	24,000	186,000	6,000	330,000	339,000	70,000
Jamaica	37,000	55,000	323,000	1,396,000	15,460,000	3,506,000	3,653,000	1,800,000
St. Kitts	1,600	3,000	19,200	102,000	.	257,000	203,000	70,000
St Lucia	980	3,700	13,600	50,000	83,000	12,000	149,000	32,000
St Vincents ..	1,300	2,800	23,500	222,000	.	160,000	395,000	82,000
Tobago	320	1,200	12,500	121,000	.	500,000	165,000	41,000
Trinidad	4,200	16,000	24,000	241,000	.	62,000	355,000	260,000
These and other Places	77,460	113,890	692,700	3,816,000	19,769,500	7,808,000	8,603,000	4,035,000

The Canadas export to Great Britain about a million loads of timber, furs to the amount of 100,000*l.*, some wheat, and 20 to 30,000 barrels of pot and pearl-ashes; besides lumber to the West Indies.

1,100,000 trees, or loads of 50 cubit feet each, were imported from Canada and other countries in 1829.

By the 3d and 4th of William IV., c. 73, slavery is utterly abolished in the British Dominions and Colonies from August 1, 1834, except in regard to certain temporary arrangements in the Colonies. The price of this manumission was 20 millions.

Guayana is the coast from the Orinoco to the Amazons, about 700 miles. The English, to the north, 200 miles; the Dutch next, 200; and the French 300. The territories run 300 miles into the interior. The chief places of British Guyana, or Demerara, are Stabrock and George Town; of Dutch, or Surinam, is Paramaribo; and of French, Cayenne. They are close to the Equator; *i. e.* between 2° and 8° N. lat.

Honduras yields about 10,000 tons of mahogany, and Jamaica and St. Domingo about 1000.

The water and canal communications in Canada are made perfect, both by nature and art. Ships can sail from the Atlantic, 1500 miles on the St. Lawrence, the canals, and Lakes Erie, Ontario, and Huron, as far as the Channel to Lake Superior. Canals, too, are made by connecting the higher levels of the lakes at their entrance and exit, by banks, instead of deep cutting.

The Welland Canal joins Lakes Erie and Ontario, hitherto disjoined by Niagara.

Lake Erie is 565 feet above the Hudson, at Albany. The communication is opened by the Erie Canal, 363 miles long, with 84 locks, 650 fall, and 48 rise. It cost 1½ million sterling.

Albany, a fertile district on the Eastern coast of the Cape Colony, whose Port, Elizabeth, is in Algoa Bay, has latterly become a promising colony; the climate is fine, and the trade with the interior considerable and profitable. Graham's Town, its capital, is now a large place.

New South Wales is now settled over 4° of latitude, and has a population of 65,000 free settlers, and 35,000 convicts. Tasmania is still more promising. The exports are 3 million lbs. of fine wool, besides New Zealand flax; and the imports nearly a million.

The natural herbage and woods of Tasmania are dark green, approaching to brown. Hobarton is the thriving capital at the mouth of the beautiful Derwent on the south side. It is 120 miles across to Launceston, and from this to New Holland about 300. The variations of heat are often 30° or 40° in blowing days. The vine flourishes, and yields fine wine, and most English seeds thrive abundantly. From October to February there were, in 1830, 42 rainy days, 24 windy, and 57 fine days; ther. from 56° to 99°. The servants are convicts, who, for a few years, get no wages, and cost about £25 per annum. Their number is 15,000, nearly half the whole population. The Island contains 15 millions of acres, one-third useless to man. The wool is sought in England for fine purposes, and the wheat weighs from 60 to 65 lbs. per bushel.

Extent, in acres, of each of the British West Indian Colonies.

Colonies.	Cultivated.	Uncultivated.
Demerara and Essequibo...	800,000	in infinitum.
Berbice	300,000	ibid.
Trinidad	27,275	1,500,000
Tobago	40,000	60,000
Barbadoes	101,470	5,000
Grenada	50,000	30,000
Saint Vincent....	50,000	54,286
Saint Lucia......	35,000	60,000
Dominica	86,436	100,000
Antiqua	44,838	15,000
Montserrat......	12,000	9,000
Nevis	15,000	6,000
Saint Christopher	30,126	13,600
Virgin Islands ..	12,000	9,000
Jamaica	809,450	1,914,812
Bahamas........	50,000	150,000
Bermudas	12,500	—

Honduras is a dependency of Jamaica; and extends about 270 miles along the coast.

Ascension is 39 miles round, and has an English garrison.

St. Helena, on its first discovery, contained sea-fowls, and some seals and turtles, with a forest of trees and shrubs, all of peculiar species, with one or two exceptions. It is now a mere rock, devoured by rats.

The French colonies are Martinique, Guadaloupe, Marie Galante, and Deseada, in the West Indies; Cayenne, in South America; Algiers, Senegal, and Goree, in Africa; Bourbon, in the Indian Ocean; St. Marie, in Madagascar; Pondicherry and Chandernagor, in the East Indies.

The Republics of Columbia and Bolivia include provinces whose coasts are bounded by the Caribbean Seas and the Pacific, extending over 20° of longitude, and 8 of latitude, or about 1200 miles by 500.

The plains, watered by the great rivers of South America, are called Calobaza, Apure, Oronoco, and Llanos, which last is a sandy desert, like that of Sahara, in Africa, and so level, that, in 18,000 square miles, the inequality does not exceed five inches. The heat is from 110 to 115°. In the rainy season it is flooded by the rivers.

The river Amazons rises in the mountains of Quito, and runs 3400 miles before it discharges itself, by ten channels, into the Atlantic. When joined by the Apurimac, it is 150 miles wide, and is 40 fathoms deep, 1500 miles from the sea.

The road from Port La Guayra to Caraccas resembles that over St. Gothard, and the elevation of Caraccas produces a day temperature of 67° to 70°, and a night of 60° to 64°, with luxury of production.

The Oronoco is the country of mosquitoes and insects. No one can sleep, except

among cattle, which they prefer to man; or in a hole, from which they have been expelled by smoke. The table-land, at 400 yards high, is free from them; and this tract extends hundreds of miles, to forests which adjoin the Andes.

The Llanos, or Pampas, of South America, are green in the rainy season, and burnt up in the dry season.

Bermudas, in the Atlantic, has 9000 inhabitants, free and coloured.

Gibraltar, 15,000; Malta and Goza, 123,000; the Cape, 55,675, and 76,000 coloured and blacks.

Sierra Leone has but 85 whites, and 33,500 blacks; and Gambia but 45 whites, and 3700 blacks.

New South Wales has 60,000 free English, and 24,500 convicts; and Van Diemen's Land has 37,700, of whom 15,500 are convicts. Swan River, &c. about 2000.

The Rock of Heligoland, 2220; and is visited by only one trading-sloop per annum.

The Ionian Islands contain 195,000 inhabitants, and employ about 60 ships.

The Hudson's Bay Company employ five ships.

The aborigines of New South Wales and Tasmania are not ferocious, unless insulted and ill-treated. The women carry their children, wrapped in opossum-skins, on their backs, and the tribes live much on the white ants of their large ant-hills. The men hunt opossums in the tops of lofty and inaccessible trees, and use the fur for thread and sashes. Their houses are not covered, but consist of bark, boughs, &c. laid to windward. Their arms are stone tomahawks and spears, sharpened with flints.

Our Transatlantic colonies cost, in direct expenditure, about 2½ millions per annum; and we could get all their products cheaper without them, for we levy heavy duties on the same products from other countries.

The Boston Almanac estimates the population of the two Canadas at 900,000, and of Nova Scotia, &c. at 300 000.

BRITISH CONSTITUTION & LAWS.

[*Since the publication of the last Edition of this Volume, the Author has considered it expedient, for the more general diffusion of constitutional knowledge, to write a popular tract, which he calls a Catechism of the British Constitution. A formal treatise would have been a waste of labour, and the practical results are exhibited, so as to instruct readers of every class and age. In like manner, with a view to render the elements of British History, and its social arrangements, far more popular than in any other existing form, he has written a Grammar of British History, which will prove most worthy of general perusal by all who seek the best intelligence.*]

PROGRESS OF CONSTITUTION.

Law, in its general sense, signifies a rule of social conduct, which superior authority has dictated, and which the community are bound to obey. The law of nature is a principle of self-love, or the individual pursuit of *happiness*. The law, in practice, however, is the primary and chief cause of half the *miseries* of human life, owing to the chicanery of its professors.

Government, a subject deeply interwoven with the happiness and comforts of the human race, has been that arrangement over which *wisdom* has always had the least controul. Most governments are founded on usurped power, and are results of pride and self-interest. For the most part, they have arisen from military conquest, or some accidental ascendancy during an insurrectionary movement; and the rule of government has, in consequence, been the will of a leader on one side, and abject submission of the rest of the community on the other. No check on power has existed but in the forbearance or idleness of the ruler, or in the scruples of his agents; and, if checks have been introduced, they have been either mere concessions of policy, or have been rendered inefficient by colourable forms, or by various sinister and counteracting influences.

The expediency or inexpediency of hereditary governors, by a law of succession, depends on the perfection of the Representative System. If this is perfect, that is, if every 10 men elect a local representative, and every tenth of these is chosen an elector, by ballot, we then, but then only, assure such good intelligence, in a National representation, that it may be entrusted to decimate itself for a senate, and the senate may be depended on for the choice of ministers, and these for the selection of an annual president. But, if the system of representation is imperfect and partial, or is left open to intrigue or corruption, then the only security is hereditary succession against a scramble among demagogues to attain, by confusion, the apex of the social pyramid.

The laws of England are made up (1) of the acts or statutes of the legislature; (2) of decisions of judges, which are reported or recollected, and of such of the *dicta*, records, opinions, and usages of the writers, courts, and practitioners of the law, and of public usages as have been sanctioned by time, and which, in case of any question, the judges feel themselves bound to respect. This branch consists of two divisions, one called Common Law and the other Equity. (3) The Romano-Civil Law, or Code of Justinian and others, consists of the Institutes, Digests, Pandects, and Imperial Constitutions or Novels. The Canon or Romish law, consisting of the Decretals, Epistles, Bulls, &c. published by the Popes of Rome, from 1150 to 1580. The two foreign systems guide our Ecclesiastical, Admiralty, and University Courts.

The laws of England are intricate and embarrassed, because they are a succession of patch-work laws to amend and improve, and not harmonious wholes, with parts exactly fitting and squaring one with another.

The Government of England is a constitutional monarchy, in which the power of

the sovereign is supported by the influence of the aristocracy in the House of Peers, and regulated by that of the democracy in the House of Commons. The executive authority is vested in the King, Sheriffs, and Judges; the legislative, in the King and two Houses of Parliament. The King has the power of appointing all the great officers of state, and all the executive acts of the government are performed in his name.

The peculiarities of the legal constitution of England are—the parliament, equity jurisdiction, ecclesiastical jurisdiction, corporation franchises, and the compulsory maintenance of the poor.

The free parts of the English constitution, and the securities of civil liberty, were procured by Magna Charta, in 1216, by Simon de Montford, Earl of Leicester, who obtained the first parliament in 1256,—by the concessions of Edward I., in return for subsidies to sustain his wars,—by the Trial by Jury,—by the Petition of Right, drawn by Lord Coke,—by the Habeas Corpus Act, drawn by Lord Shaftesbury,—by the Bill of Rights and Act of Settlement,—by the Libel Bill of C. J. Fox,—by the Catholic Emancipation Bill,—and, finally, by the Reform Bill of 1831, planned by Lord Grey.

In general, it cannot be denied that the English Constitution is one of property and money; and, hence, power is too much enjoyed by hereditary imbecility, avaricious accumulations, and grinders of the middle and poor classes. The main scheme and design is good; but, in practice, industry, virtue, and genius, are obliged to yield to avarice and the factitious possession of wealth. The Courts of Justice are open to all, but they must be entered with plenty of money.

ROYAL TITLES, &c.

Henry VIII. was the first King of England who received the title of Majesty. Before his reign, the Sovereigns were usually addressed "My Liege," and "Your Grace." The latter epithet was originally conferred on Henry IV.; "Excellent Grace" was given to Henry VI.; "Most High and Mighty Prince" to Edward IV.; "Highness" to Henry VII.; which last expression, and sometimes "Grace," was used to Henry VIII. About the end of this reign, all titles were absorbed by that of "Majesty," by which Francis I. addressed him at their interview in 1520. James I. coupled to this title the present "Sacred," or "Most Excellent Majesty."

Before the union of the Crowns, Britain alone was in general use in the style of our Sovereigns, to signify England and Wales. Egbert, &c. was called *Bretwelder;* Alfred *Basileus;* "Governor of the Christians of Britain;" Edgar, "Monarch of Britain;" Henry II., "King of Britain;" and John, "Rex Britanniorum, King of the Britons."

The royal style, settled on the 5th of November, 1800, on the union with Ireland, which was to commence from the 1st of January, 1801, runs thus:—"George the Third, by the Grace of God, of the United Kingdom of Great Britain and Ireland, King, Defender of the Faith, and of the United Church of England and Ireland, on Earth the Supreme Head."

In Latin, "Georgius Tertius Dei Gratia Britanniarum Rex," &c.

The HOUSEHOLD of the King of England is governed by a lord-chamberlain and vice-chamberlain, with 8 clerks; there is a keeper and secretary of the privy-purse; a master of ceremonies and assistant; 19 gentlemen-ushers; 14 grooms of the privy and great chamber, a groom of the stole, 12 lords of the bed-chamber; 12 grooms of ditto; a master and a groom of the robes; 16 pages, 40 gentlemen of the privy-chamber, 8 serjeants-at-arms, 8 messengers, 25 musicians, 8 trumpeters; a lord-steward, a treasurer, a comptroller, a master of the household, 3 clerks and 3 messengers, a pay-master, a lord-high-almoner, a sub-almoner and a grand almoner; 3 officers of the envoy, 6 of the silver scullery, 7 of the coal-yard, 12 of the wine-cellar, 3 in the confectionary; 5 clerks of the kitchen, a chief-cook, 2 master-cooks, 25 men-cooks and apprentices, 2 yeomen of the mouth, 2 of the kitchen, 2 table-deckers, 4 directors of gardens, 2 librarians, and 2 clerks; a master of the tennis-court, a keeper of the swans, a surveyor of pictures, and a poet-laureat; a master of the horse, a grand-falconer, a master of the buck-hounds, a chief equerry, 4 equerries, 4 pages of honour; 2 riders, a huntsman, 2 feeders, 3 whippers-in, and 131 yeomen of the guard, and their officers. Besides keepers of palaces, porters, female servants, &c.

There are 16 king's messengers for foreign service, 6 for the home-office, 8 attached to the foreign-office, and 6 to the colonial.

The band of gentlemen-pensioners are 40, with 6 officers. The first have salaries of 100*l*. per annum.

There are 24 ROYAL PARKS, with appointed rangers or wardens, enjoying many immunities. WINDSOR-FOREST is 66 miles round, including the great and little parks.

The DUCHY OF LANCASTER has its chancellor, and 30 officers and assistants.

There are between 40 and 50 clerks and state-officers connected with the collection of the revenues of the DUCHY OF CORNWALL.

There are ROYAL ESTABLISHMENTS at St. James's, Buckingham-house, Kensington, Kew, Hampton Court, Windsor, Brighton, and Edinburgh; with sundry officers and assistants at each; and Kensington, Kew, Hampton-Court, and Windsor, have extensive domains. At Holyrood House, the state-officers of the kings of Scotland, before 1603, are still retained.

There were, in 1830, 169 PRIVY-COUNCILLORS, 113 of whom divided, annually, 650,000*l*. of the public money, of which, 86,000*l*. is in sinecures, and 121,650*l*. in pensions; 47 of them are peers, who divide 378,816*l*., and 22 commissioners, who divide 90,849*l*.

Besides the ATTORNEY and SOLICITOR-GENERAL, the Crown is supported by an ancient serjeant, 4 serjeants, and 38 king's counsel.

EXECUTIVE GOVERNMENT.

The permanent constitutional councils of the King of England are,—the Parliament in legislation, the Judges in matters of law; and the Privy-council, of which the Cabinet of ministers is a select committee, in regard to foreign and domestic policy.

The King's Ministers, or the Political Administration of the Government, consists of a select number of the Cabinet Council, who hold executive offices. They have been 9, 10, and 12, but are now 13 or 14.

	Salary.
First Lord of the Treasury	£5,000
Chancellor of the Exchequer	5,000
Lord Chancellor	14 000
President of the Council	2,000
Lord Privy Seal	2,000
Secretary of State for the Home Dep.	5,000
Secretary of State for the Foreign do.	5,000
Secretary of State for the Colonial do.	5,000
First Lord of the Admiralty	4,500
President of the Board of Control	3,500
Post master General	2,500
Chancellor of Duchy of Lancaster	3,500
Paymaster of the Forces	2,000
Chief Secretary of State for Ireland	5,500
	65,500

There are also—

A Secretary at War	2,580
Commander-in-chief of the Forces	3,458
Master-General of the Ordnance	3,000
Mast. Mint and Pres. Board of Trade	2,000
Lord-Chamberlain	3,058
Lord-Steward	2,436
Master of the Horse	3,350
Groom of the Stole	2,130
First Commissioner of Land Revenue	2,000
Treasurer of the Navy and Vice-President of the Board of Trade	2,000
Attorney-General	6,200
Solicitor-General	4,000

Ireland has a

Lord-Lieutenant	20,000
Lord-Chancellor	8,000
Commander of the Forces	3,607
Attorney-General and Solicitor-Gen	3,000

The TREASURY is under the direction of 6 lords-commissioners, 2 secretaries, 6 chief clerks, and about 120 other clerks.

There are 3 SECRETARIES OF STATE. Home, Foreign, and Colonial, each with the 2 secretaries, and a chief clerk; and, in the first, a secretary, under-secretary, and chief clerk for Ireland. Each of them employs about 30 clerks.

For the ADMIRALTY, there are 5 commissioners, with a secretary, and about 60 clerks.

The High Court of Admiralty has two judges, 2 advocates, 2 proctors, a registrar, &c. &c.

The WAR-OFFICE, in 1830, was under a secretary and under-secretary, with about 80 clerks, and 16 messengers.

The office of the COMMANDER-IN-CHIEF has 4 secretaries, 4 aides-de-camp, and 12 clerks.

The BOARD of Royal WOODS, FORESTS, &c. is under 3 commissioners, and employs about 30 clerks and 20 receivers.

The Board of Public Works is under a surveyor-general and assistant, aided by 25 clerks, architects, &c. &c.

The NAVY-OFFICE, for all details of the Navy, has a comptroller, a deputy, 3 commissioners, and above 100 clerks and assistants. There is also a Navy-Marine Pay-Office, with treasurer, pay-master, and about 80 clerks.

There are three Head-Commissioners of the execrated new Poor Law, and 21 Sub-Commissioners, with salaries amounting to £49,180.

There are 14 Executive Commissions, deemed more or less jobs of patronage; as the Poor Law, the Tithe, the Criminal Law, the Factory, the Church, the Prisons, Irish, Education, South Australian, Hand-loom Weavers, Lunacy, Rural Police, Shannon, Metropolis Roads, and Registrar-General.

The Executive Government of IRELAND resembles that of England, with a privy-council of 57, and officers of state, clerks, &c. &c.

The longest administrations since the accession of George III. were,—Lord North's, from Feb. 1, 1770, to March 27, 1782; W. Pitt's, from Dec. 27, 1783, to March 7, 1801; and Lord Liverpool's, from June 8, 1812, to April 11, 1827.

PEERAGE AND RANKS.

HERALD'S COLLEGE has an earl-marshal, 3 kings of arms, 6 heralds, 4 pursuivants, and 2 extra heralds. It was founded by Edward III., in the age of tilts and tournaments. There are 6 heralds attached to the college; Richmond, Lancaster, Chester, Windsor, Somerset, and York. Pursuivants are attendants on heralds. There are, at least, 50,000 coats of arms in use.

The House of Lords is composed of all the five orders of nobility,—dukes, marquesses, earls, viscounts, and barons, who have attained the age of 21; of 16 representative peers from Scotland; 28 representative peers from Ireland; 2 English archbishops and 24 bishops; and 4 representative Irish bishops:—The number of each averages as follows:—

Dukes	25	Peers of Scotland	16
Marquesses	19	Peers of Ireland	28
Earls	106	English Bishops	26
Viscounts	18	Irish Bishops	4
Barons	185	5 or 6 more or less.	

Classes in the Peerage are distinguished by the number of classes in their state robes.

The Peers are hereditary Counsellors of the Crown, and their privileges are hereditary. A Peer may vote by proxy; and when sitting in judgment he gives his vote upon his *honor*.

Of living titles, Elizabeth created only 2; James I. 10; Charles II. 14; George II. 18; but George III. 124, and George IV. 85.

The business of the House of Peers is chiefly directed by the Chairman of the Committees, whose powers are very great and operative; and a House is usually formed of him, the Chancellor, and Junior Bishop, who attends to read the prayers.

Henry VII. had only 28 temporal peers, and Henry VIII. but 36 in their first parlia-

2 S

ments. Charles II. 154. In 1840, there are about 450.

271 new peers have been created since 1760, of whom the Pitt Administration created 90, and the Liverpool 50. But, from 1260 to 1760, only 138 were created, of whom 56 were from the Revolution to 1760.

Ireland has 226 Peers, of whom 32 are representative, and 67 have English titles.

The business of the HOUSE OF PEERS is almost entirely performed by the Speaker, (the Chancellor,) and the Chairman of Committees, who reads and revises, as well as exercises a provisional veto on all bills; these, and the junior Bishop, who attends to read the prayers, usually make a house.

The House of Lords is an appellate court, but its functions are performed by the Lord Chancellor, and one or two lords in rotation. In it, estate and individual bills usually originate, and are referred to the Judges.

Lord is a general name for a Peer, and also applied to several offices, as Lord Chancellor, Lord Mayor, &c.

The first dukes were Edward the Black Prince as Duke of Cornwall, and John of Gaunt Duke of Lancaster. The title was extinct in the reign of Elizabeth, and till James I. made Villiers Duke of Buckingham.

Ladies Harcourt, Gray, and Suffolk were, by Edw. III., Hen. V. and VI., made knights of the garter, and wore it above the elbow of the left arm.

At a coronation, our male and female nobility carry with them the coronets of their rank, and put them on when the king and queen are crowned.

There are about 400 baronets; 130 Scotch, and 90 Irish.

There are about 120 knights' bachelors, knighted in person by the king; and about 200 brevet and foreign knights, taking titles, but not enrolled or gazetted as such.

There are also various ranks of naval and military knights.

A knight was made formerly by a kiss on the cheek, and now by the laying the royal sword on the left shoulder.

The Order of the Garter was instituted in 1350; that of the Thistle was revived in 1687; that of St. Patrick was instituted in 1783; that of the Bath was revived in 1725; and, of this last, there are knights' grand crosses; a second class, and a third class, all naval and military; about 750 in the three classes.

HOUSE OF COMMONS.

The earliest parliamentary roll extant is of the 18th Edward I. It is a grant to the king, by several peers, for the marriage of his daughter. The 9th of Edward II. is a grant by the citizens, burgesses, and knights. In 13th Edward III., the Commons granted 30,000 sacks of wool; but, on the same day, the earls and barons, for themselves and peers, by barony granted every 10th sheaf, every 10th fleece, and every 10th lamb. In 18th Edward III., the Lords and Commons made separate grants. The Speaker was called Parlour, or Procurator, till 1st Henry IV.

In the 40th Edward III., the Lords met in the White Chamber, or Court of Requests, and the Commons in the Painted Chamber.

The House of Commons consists of knights, citizens, and burgesses, respectively chosen by counties, cities, and boroughs. The first known Speaker was Petrus de Mountford, chosen in 1260, Henry III. In the reign of Henry VI. the number of members was about 300; in the first parliament of Henry VII., 298; in James I., 493; but, since the Union of Ireland in 1801, it has been 658.

The duration of Parliament was formerly for three years; but the Septennial Act, in 1715, in a moment of alarm, extended the duration to seven years, unless dissolved; and the last 8 continued, on the average, but 3¼ years.

The presiding officer of the House of Commons is the *Speaker*. In the House he sits as moderator or chairman, and in this capacity he never *speaks*, except for the due observance of the rules and usages of debate. When his mace is *on* the table, (40 members being present) the assembly is "a House;" when *under* the table, it is "a Committee," when the Speaker takes his seat among the members, and speaks on the subject like any other member addressing the Chairman of the Committee.

The Speaker is the great functionary of the House of Commons, which is, in most respects, entirely regulated by him, just as the lords by the Chairman of Committees; and, by the Speaker and his clerks, a great portion of the public business is transacted. In addition to his salary and fees (altogether about £10,000 per annum) the Speaker receives £1000 of *equipment* money, and 2000 ounces of plate on his election; 2 hogsheads of claret, and £100 for stationery, annually; besides a superb house, with extensive offices.

Cornwall was Speaker from 1780 to 1784, Addington to 1800, Mitford to 1802, Abbot to 1817, Sutton to 1836, Abercrombie to 1839, and Lefevre, the present Speaker.

On June 4th, 1832, the English Parliamentary Reform Bill passed in the House of Lords; and, on June 7th, the royal assent was given by commission. This bill deprived 56 nomination or decayed boroughs of the abused right of returning 112 members to the House of Commons; and it conferred on certain 10*l.* householders the right to vote, besides extending it to large classes of farming tenants, and giving to large new towns the right of returning members. A bill for reforming the still more abused representation of Scotland, received the royal assent in July, and another for improving that of Ireland in August.

The longest sessions of parliament in this century was 270 days, in 1803; 266, in 1811; and 268 in 1814; and the sitting days respectively 146, 135, and 127, of seven or eight hours each. The greatest attendances were 608, March 22, 1831, on the Reform Bill; 603, July 6, on same; and 553, March 6, 1827, on the Catholic Bill.

The Reformed House of Commons is composed as follows:—

ENGLAND.

26 Counties, 4 each; 7, 3 each; 6, 2 each; Yorkshire 6; I. of Wight, 1	144
133 Cities and Boroughs, 2 each	266
53 Boroughs, 1 each	53
City of London	4
Universities of Oxford and Cambridge, 2 each	4
	471

WALES.

3 Counties, 2 each; and 9 Counties, 1 each	15
14 Districts of Boroughs, 1 each	14
	29

SCOTLAND.

33 Counties	30
Edinburgh and Glasgow, 2 each	4
18 Boroughs and Districts of Boroughs	19
	53

IRELAND.

32 Counties, 2 each	64
6 Cities, 2 each; 27 Boroughs, 1 each	39
The University of Dublin	2
	105
Total	658

As a mean summary, the County Members and Registered Electors are,—

England	144	344,564
Wales	15	25,815
Scotland	30	33,115
Ireland	64	60,607
	253	464,101

i. e. 1834, on the average, to a member, of whom about half are £50 farming-tenantry-at-will, and a large proportion non-resident.

The City and Town Members are returned by the following registration:—

England	327	274,649
Wales	14	11,309
Scotland	23	31,332
Ireland	41	31,545
	405	348,835

i. e. 861, on the average, to a member, of whom one-fourth are freemen of corporate bodies.

The last registration has raised the counties to about 1900 to a member, and the towns to about 920.

The persons qualified are supposed to be one-third more; but they decline to register, for the purpose of evading the responsibility of an open vote; and, in case of question, to avoid an exhibition of their private affairs.

A *mean* summary is all that can be given, for in the different reports no two agree, and every return varies.

The privileges of Parliament are of speech, and personal freedom from arrest. Several vexatious privileges were abolished by 10 Geo. III., c. 50.

Both Elizabeth and James I. retained a parliament for 7 years and 10 months. The Long Parliament sat from Nov. 3, 1640, till April 20, 1653; and a Parliament of the infamous Charles II. sat from May 8, 1661, till Jan. 24, 1678. The first Parliament of George I. declared its own right to sit from 3 years to 7 years, and this Septennial Bill still exists.

The number of Parliaments in each reign, were—

Edward I.	8	James I.	4
Edward II.	15	Charles I.	3
Edward III.	37	Cromwell	4
Richard II.	26	Charles II.	5
Henry IV.	10	James II.	1
Henry V.	11	William III.	4
Henry VI.	22	Anne	5
Edward IV.	5	George I.	2
Henry VII.	8	George II.	5
Henry VIII.	12	George III.	14
Edward VI.	4	George IV.	3
Mary	5	William IV.	4
Elizabeth	6		

That is, 213 parliaments in 530 years.

An *adjournment* of Parliament is the temporary postponement by the House of its meetings. A *prorogation* is a postponement of both Houses, by royal authority, from one session to another. A *dissolution* is the civil death of the Parliament.

Laws to impose any tax, fee, toll, &c. on the subject, must originate in the House of Commons. Other public or private bills may originate in either House. Public bills are brought in, on motion, after notice and leave given.

The movers get them prepared, and then present them to the House in a skeleton form. The title is then read; this is called the *first reading*. On the *second reading*, the principle of the bill is usually contested, and it is either withdrawn, or thrown out, or referred to a committee for the settlement of the details. In the committee the bill is debated, clause by clause, and amendments are made. The bill is then printed for the use of the members. The amendments of private committees are reported to the House for confirmation or disagreement. The bill is then ordered to be engrossed. It is then read a third time. Amendments are made. It is passed, and the title added, or it is thrown out.

When passed in the House of Commons, the mover, with other members, carries it up to the bar of the House of Lords. The lord-chancellor comes from the woolsack, and receives it. It then passes through the same forms in the other house. If rejected, no other notice is taken. If passed, or amendments are made, it is sent back to the House of Commons. Any amendments are there again debated. If agreed to, the bill passes to and from. But, if disliked, a *conference* is had, and the difference is adjusted, or the bill dropped.

The royal assent is given, 1. By the queen; 2. By commission; in old French.

The qualifications of Members, for Counties, must be £600 per annum; and, for Boroughs, &c. £300, clear of all incumbrances.

The CHILTERN HUNDREDS are an estate

of the crown, on the chalk-hills which lie between Bedford, Oxford, and Buckinghamshire; and the stewardship is conferred, for a small fee, on members who desire to vacate their seats by an office which renders them ineligible.

The Saxon popular assemblies, called Wittenagemots, were virtual Parliaments. Great councils were held by the early Norman kings, in which the king's tenants, *per capite*, and the barons assembled. By these councils, taxes, aids, and escuage, were granted.

In 1284, Edward I. convened the Parliament at Acton Burnel, between Shrewsbury and Wenlock. The Peers met in the castle, and the Commons in a large barn.

The Speaker and 40 members constitute a House of Commons.

Before members of parliament paid themselves out of the public money, their constituents used to allow a knight of the shire 4*s*. per day; and burgesses 2*s*.

The House of Commons has an establishment of about 60 clerks, door-keepers, &c. The House of Peers about 40.

In 1838, 19 Inclosure and 2 Draining Acts passed; 1 for a new company; 42 for local improvements; 46 for communications, including 16 for railways; 8 for harbours, &c.

The right of 50*l*.-tenantry and of freemen to register, was a concession to the Tories while the Reform Bill was in progress. In consequence, the aristocracy influence the County Returns in the votes of dependent tenantry, and bribery has full weight among the destitute freemen of old corporations.

The 172 revising barristers, for 1837, cost £31,081. In 1836, the registered electors were, in England, 737,316; in Wales, 31,898; and, in Scotland, 41,885; exclusive of the Universities and Isle of Wight.

LAW-BOOKS AND AUTHORITIES.

Glanville, in the age of Henry II.—Bracton, of Henry III.—Britton, of Edward I.—Fleta, of Edward III.—Fortescue, of Henry VI.—are the most ancient writers on the common law. *Bracton* drew his materials from the Justinian Code. *Glanville*, in some places, refers to statutes passed in the Great Council, of whose existence we have no other intimation.

Common law is the unwritten law of the country, founded on custom, usage, and maxims of common sense; but it is varied by written, printed, or Statute Law, made for the purpose of correcting and defining common law.

The British laws were translated into Saxon in 590. Alfred compiled the Saxon common law, in 885. Edward the Confessor promulgated laws, 1065. Stephen's charter of general liberties was in 1136. Henry the Second's confirmation, 1154 and 1175. Magna Charta, by John, 1215. Confirmations, by Henry III., in 1216, 1224, 1227, 1250, and 1264. (Forest charter, 1225.) By Edward I., 1297 and 1299. By Edward III., in 1345 and 1368.

The curfew-bell was a law only till the accession of Henry I. Since that time, the eight o'clock evening-bell has been a custom only. Henry voluntarily proclaimed the first charter of liberties, which was confirmed by Stephen and Henry II., but neglected till extorted from John.

The Year Books were Reports from the reign of Edward II., taken by an appointed officer, at the expence of the State, and published annually. Such reports have been since continued by private hands.

The first statistical survey of England was Domesday Book. The second, the *Rotuli Hundredorum* of Henry III. and Edward I. The third, the *Valor Ecclesiasticus*, of 1537. The fifth, the Custom-House Returns of 1694. The sixth, Poor Rates of 1750 and 1776. The seventh, Sir John Sinclair's Scotland. The eighth, Moreau's valuable books. The ninth and best, Marshall's General Statistics of the Kingdom. The tenth, the Parliamentary Returns of the Population, &c.

Domesday Book, the most ancient record in Europe, is the report and returns of a survey of nearly the whole of England, made by order of William I. It consists of 2 vols., and has been illustrated by Kelham, and published verbatim by the Record Commissioners. The distribution of the counties in the two volumes, and the orthography of their names, are given below. The survey of the four northern counties is not contained in that record, but they are in another, called the Boldon Book.

VOL. I.

Chenth.	Herefordscire.
Sudsexe.	Hunteduncire.
Sudrie.	Bedefordscire.
Hantescire.	Northantscire.
Berrochescire.	Ledecestrescire.
Wiltescire.	Warwicscire.
Dorsete.	Hartfordscire.
Sumersete.	Sciropescire.
Devenescire.	Cestrescire.
Cornvalgie.	Inter Ripam and Mersham, (Lancashire.)
Midelsexe.	Derbyscire.
Hertfordscire.	Snotinghamscire.
Bockinghamscire.	Roteland.
Oxonfordscire.	Euvicscire.
Glowecestr'scire.	Lincolnscire
Wirecestrescire.	
Gentebr'scire. (Cambridgeshire)	

VOL. II.

Exsessa. Norfulc. Sudfulc.

It divides the land into oxgangs, or bovates, of 12 or 15 acres; virgates of 40 acres; carucates of 8 oxgangs, or 100 acres; and hides of about 120 acres more.

In Domesday Book a carucate, or 100 acres, was valued at only 32*d*., and 4 at 10*s*.; and sometimes at only 8*s*.

The barons, or tenants in chief, or freeholders, by Domesday Book, were 730; but, being split into small parts, were greater and lesser, all of whom were entitled to sit in parliament; but, in 1307, the lesser barons were allowed to choose two representatives; hence called knights of the shire.

In 1215, the barons took the field at Stamford, under Robert Fitzwalter, Baron of Dunmow, and John met them on June 15,

at Runnemede, a meadow between Staines and Windsor, when the great seal was affixed to the charter, and 25 barons, elected to secure its fulfilment, were put in possession of the Tower of London. Twelve knights were also appointed to rectify the forest laws. John was so indignant, that he died in October, at Newark, as was said, by poison, or of a broken heart. His son, Henry III., afterwards confirmed them in 1236 and in 1253, in Westminster-hall, with great solemnity. Edward I. did the same, before he could obtain supplies or service. There were, therefore, five charters—one of John, three of Henry, and one of Edward I., the same in spirit, but slightly varied in expression.

Magna Charta provides that fines or amercements shall never destroy a man, and, therefore, all such are unlawful. It saves a freeholder's estate, a merchant's merchandize, a scholar's books, a workman's tools, &c. By Magna Charta, 10*d.* was fixed as the price per day of a cart with two horses, and 1*s.* 2*d.* with three.

The Charta de Foresta was of the same year. It retained many vexatious provisions, and some interesting ones; thus it shows the early use of marl in agriculture, the value of honey before sugar was abundant and cheap, and the ecclesiastical epicurism in forest venison.

Parliaments were fixed by the 14th chapter of Magna Charta, by a pledge to summon archbishops, bishops, abbots, earls, and great barons; and, by the sheriffs, all who held a fief, after 40 days' notice, which was to express the cause; and, by chapter 13, it is provided that no scutage or aid should be imposed, unless by this council.

The original of Magna Charta, preserved in the British Museum, is 14½ inches broad, and 20½ long. Another copy is 17 by 21. Originals of Magna Charta, or contemporaneous copies of it and confirmations, are also in the Museum, the Chapter Houses of Lincoln, Durham, Norwich, and Wells; in Corpus-Christi, Cambridge, and Oriel, Oxford; in the Bodleian and Ashmole Museum. At Rochester is a charter of liberties, granted by Henry I. in 1101, and at Exeter another, by Stephen, in 1136.

The language of Charters and Statutes were in Latin or French, till Henry VII. The statutes of Henry III. are in Latin. The first use of English was in 36th Edward III.

Records in court were written in Latin, till the Commonwealth.

French was used in all proceedings of courts of law, until ordered to be in English by 6th Edward III., "because the king and his nobles had, in travel, observed that people were better governed by laws in their own tongue." But law books were written in law French, even so late as the reign of William and Mary; and the barbarisms of this language still compose a large part of our legal nomenclature.

There are about 50 volumes of indexes, digests, and abridgments of law and equity.

Littleton's Tenures is a small tract, compiled in the reign of Edward IV. out of the Year Books, and by its editors broken into 750 sections. This work Sir Edward Coke employed as the text of his common-place book, and he published an edition of the Tenures, calling it The First Institute. Coke also published three other books, which he called the Second, Third, and Fourth Parts of the Institute.

5500 copies are now printed of new public acts, and 300 of others. The public ones are sent to members, public offices, justices of the peace, sheriffs, town clerks, &c. free.

Ruffhead's edition of the Statutes at Large, consists of 32 volumes quarto. Seven and a half comprise the legislation from Henry III. to the accession of George III., but in that single reign 16½ volumes were added, and twelve since!

In America, the laws have been condensed, and, in 1829, the local and general laws were in New York reduced to a portable and comprehensible form; but this is not done in Britain, because 30,000 persons flourish by what they call "*the glorious uncertainty.*"

The acts of UNION are those of 27 Henry VIII. c. 26, uniting Wales to England—5 Anne, c. 8, uniting Scotland to England and Wales—and 40 George III. c. 67, uniting Ireland to Great Britain.

The bench of judges, in the celebrated ship-money case of Hampden, consisted of Branston, C. J., and Davenport, C. B., who were for Hampden, on technical grounds, but against him on the question of prerogative. J. Croke, Hutton, and Denham, were for Hampden, and against the prerogative. Finch, C. J., afterwards lord keeper, Trevor, Weston, Vernon, Crawley, Berkeley, and Jones, were against Hampden, and for the prerogative; but the twelve joined in the certificate against him.

The star-chamber was opened 3d Henry VII. and abolished 16 Car. I.

De facto is applied to actual possession, and *de jure* to right.

The Habeas Corpus Act is the 31st Car. II. c. 2. The cause of its introduction was the arbitrary imprisonment of Francis Jenks, a patriotic city linen-draper. Under it, on complaint of any prisoner, (except for treason or felony) any chancellor or judge must award the writ to bring up the defendant, and bail him, if bailable.

Acquittals after bills found, on an average of years, are about one-fifth. In one case in 6 or 7, no bill is found after commitment.

Laws are enacted not for the benefit of rulers, but with a view to promote the greatest good of the greatest number.

Titles, customs, &c. are, in law, immemorial, when before Edward II., or 1340. The period of legal memory was the return of Richard I. from the Crusades. A new law makes it 60 or 40 years.

The authorities, on the laws of nations, are Groteus, Puffendorf, Barbeyrac, Burlamaqui, and Vattel.

William I., and his son Henry, were ac-

tive legislators. Their laws were made in great councils. Edward I. effected very great improvements by parliamentary concurrence. The reign of Edward III. also is distinguished in legislative history.

That distinguished patriot, MAJOR CARTWRIGHT, passed a long life in inculcating, by speeches and publications, the fundamental principles of Civil Liberty; that there ought to be Universal Suffrage, Vote by Ballot, Annual Parliaments, and cheap arms for the entire male population, to defend the country and their liberties.

In the spring of 1839, the operatives and labourers delivered to the House of Commons a petition signed by 1,285,000 persons, demanding Universal Suffrage, Election by Ballot, and other ancient constitutional Rights.

The tyrant, William, to preserve his game, made it forfeiture of property and imprisonment to disable a wild beast; and loss of eyes for a stag, buck, or boar. Of these laws, the clergy were zealous promoters; and they protested against the ameliorations under Henry III.

LAW AND LAWYERS.

The TEMPLE was established in 1185; Lincoln's-inn, 1310; and Gray's-inn, 1357. They have masters, treasurers, deans, stewards, librarians, &c.

The COURT OF CHANCERY has a lord-high-chancellor, vice-chancellor, master of the rolls, accountant-general, 16 clerks, besides secretaries of bankrupts, lunatics, presentations, briefs, appeals, with numerous clerks, &c. &c. Also 6 clerks in chancery, 3 of the petty bag, &c. &c. with numerous assistants.

The property of wards, trusts, minors, suitors, &c., standing in the name of the Accountant-General, in 1832, was about 50 millions; in 1826, it was 39 millions; and, in 1726, but £741,000. Such are the encroaching powers of this jurisdiction.

In Chancellor More's time, from 1529 to 1532, there were 133 suits per annum. In James I.'s reign they averaged 1500 per annum, and under Lord Bacon 1461. In Chancellor Nottingham's time, 1650. In Lord Hardwicke's 2000, and latterly they have been from 1500 to 2009. From 1749 to 1751, the number of equity decisions made by Lord Hardwicke was 1264, and from 1808 to 1810, under Lord Eldon, but 962.

The THREE COMMON LAW COURTS, at Westminster, have each 5 judges; and each about 60 officers, clerks, &c. &c.

The Court of King's Bench, per Lord Brougham, had 61,000 causes in 1829; which, at an average cost to both parties of 150*l*., was above 9 millions; but many cost double or treble that sum. Law expences altogether, civil and criminal, cost, in 1829, above 20 millions.

JUSTICES in LAW are the eight judges in the King's Bench and Common Pleas; and the heads are called chief justices. In the Court of Exchequer, the judges are called barons, and the chief, lord-chief-baron. They expound the statute law, and apply the common law; and make rules of court often equivalent to laws, having, in all respects, great power and discretion, but restrained by counsel, and by the verdicts of juries.

Originally, juries were 12 men, who, on oath, certified their belief of innocence. Then, in formal trials, they were the persons present; and, in time, fixed at 12.

No accusation of crime can be lawfully made by the laws of England, except before a grand jury, usually 17, sworn to secresy; and 12 of them must decide that it is true, before the party can be required to answer.

Coroners' juries consist of 17, and 13 are expected to be present during the enquiry. They are usually summoned from the neighbourhood.

Verdicts of juries must be unanimous, that every one may be responsible to his own conscience and to the parties; and, that the decision may be considered as a certainty, not a mere probability, in the ratio of the numbers *pro* and *con*.

No English judge can pass a sentence greater than the law prescribes; but he may diminish the extreme severity of the law, as the case requires.

Proof of guilt lies with the accuser, and the accused is not expected to prove a negative. Proof, also, should be positive, and not presumptive. All doubts are construed favourably to the accused: but the opinions of a judge ought not to influence a jury, every one of whom ought to think for himself, and decide for himself.

The jury are judges of the criminal intention, as well as of the fact; and they must be satisfied with proof of *both*, before they assent to a verdict, which concludes both on the fact and the criminal intention.

The Saxon penal laws went on a principle of commutation. Every man, from the king to the slave, had his price, and every limb its value, called the "were." The were of a leg or an eye was 50*s*., of a tooth 1*s*., of a finger from 6*s*. to 9*s*. A law of William the Conqueror took away all capital punishment; and, instead, directed various kinds of mutilation.

By a new statute, Courts of Sessions are holden 8 times in the year, instead of quarterly, and under the presidency of a barrister.

Sheriffs' Courts are also appointed, in districts of counties, for the trial of all questions involving less than £50 debt, or £10 damages, under the same barrister.

The COURTS OF LAW, in Scotland, consist of the Court of Session, of Justiciary, the Exchequer, Civil Jury Court, the Admiralty, the Chancery, the Signet-office, the Lord Registrars, and the Consistorial Court.

Torture was used in England previously to the Commonwealth. The Tudors were partial to it, and the Gunpowder-Plot conspirators were racked. Lord Bacon and Sir E. Coke signed many warrants to put men to the torture, and the last case was under Laud, in 1640. The *Rack* was a frame, in which the prisoner was suspended horizontally by the wrists and ancles, and stretched. The *Scavenger's Daughter* was a compressing

hoop, embracing the doubled body. *Manacles* were iron gauntlets, contracted by a screw. *Little Ease* was a cell, too small to move or exist in.

The writs issued in chancery are those which relate to the crown, which used to be kept in a *little bag;* and those relative to the subject kept in a *hamper;* and hence the hamper-office and petty-bag-office.

Before the Norman Invasion, local courts for decisions in civil causes, and often also for criminal trials, existed not only in every county, but in many large divisions of them. To increase the power of the kings, the Aula Regis, or King's-Bench, was substituted.

The jurisdiction of the courts has been from time to time extended by fictions of process and pleading.

Alfred was said to be the contriver of trial by jury, but we have evidence of such trials long before his time.

The HOME CIRCUIT goes to Hertford, Chelmsford, Maidstone, Horsham, Lewes, Kingston, Guildford, or Croydon.

The OXFORD CIRCUIT goes to Reading, or Abingdon, Oxford, Worcester, Stafford, Shrewsbury, Hereford, Monmouth, and Gloucester.

The MIDLAND CIRCUIT goes to Northampton, Oakham, Lincoln, Nottingham, Derby, Leicester, Coventry, and Warwick.

The WESTERN CIRCUIT goes to Winchester, Salisbury, Dorchester, Exeter, Launceston, or Bodmin, Bristol, Taunton, Bridgewater, or Wells.

The NORFOLK CIRCUIT goes to Buckingham, Bedford, Huntingdon, Cambridge, Ely, Thetford, Norwich, and Bury St. Edmunds.

The NORTHERN CIRCUIT goes to York, Durham, Newcastle, Carlisle, Appleby, and Lancaster.

CHESTER CIRCUIT goes to Chester, Mold, Welsh Pool, and Ruthin.

The SOUTH WALES CIRCUIT goes to Cardigan, Pembroke, Caermarthen, and Haverfordwest.

The BRECON CIRCUIT goes to Cardiff, Brecon, and Priesteign.

The NORTH WALES CIRCUIT goes to Beaumaris, Caernarvon, Bala, or Dolgelly.

The jury system of England is vitiated by there being no law to compel sheriffs and their agents to summon jurors, in the exact order in which their names stand, in three or four predetermined districts; and it is rendered illusory and inefficient, in France, by the decision being made by a majority, so that the chance of truth or error is but in the ratio of the numbers.

The number of barristers, recently, was 1132; conveyancers and pleaders, 132; London attorneys, 4342; country attorneys, 2742; total number of lawyers, in England and Wales, 13,348.

By an Act 1st Will. IV., it was enacted, that Hilary term should begin on the 11th, and end on the 31st of January. Easter on the 15th of April, and end on the 8th of May. Trinity on the 22d of May, and end June 12; and Michaelmas on Nov. 2, and end Nov. 25.

By the statutes of the 9th and 13th of William III., it is enacted, that submissions to arbitration may be a rule of any of the courts of record, and equivalent in force to the decision of a jury. These statutes are, however, unavailing, owing to *barristers* being often made arbiters, by which a decision is made according to law, and not according to equity.

A solicitor is an attorney, who conducts suits in equity.

By parliamentary returns, it appears that, in the 18 months subsequent to the panic of December, 1825, 101,000 writs for debt were issued: 71,000 by the King's Bench, 23,000 by the Common Pleas, and 7,500 by the Marshalsea-court.

CRIMINAL LAW.

The usual course of criminal proceeding is to *arrest* the suspected offender by a *warrant*, and bring him before a *Justice*, who will commit him, take bail, or discharge him. If *committed* for trial, the prisoner is *indicted* at the next goal delivery. The grand jury first determine whether the prosecution shall proceed. If they find the bill, evidence is given for the prosecution before an open court and a common jury, and the prisoner may challenge the jury, make his defence, and employ counsel. The judge sums up the evidence. The jury retire, and return to deliver their *unanimous* verdict. If guilty, the judge then passes the proper sentence. If it be of death, for treason, or murder, one of the consequences is attainder, and forfeiture of estate.

In cases of the *insanity* of prisoners, by 39 and 40 George III., c. 94, the crown is to make order for their custody. A refusal to plead puts the prisoner on trial.

As crimes are directly as inequality of social condition, and inversely as education; and as their violence is directly as want,—so all tables and speculations about crime, without reference to the causes, are mawkish and futile.

In 1837, the criminal list had swelled to 23,612, of whom 17,090 were convicted. The increase, over 1836, was 2628, or 12½ per cent.; so that 1 in 588, in England and Wales, were criminals; and, in England, only 1 in 565, or one in 280 of the adult population. 3800 of them were transported: 9500 were under 21, 358 under 12, and 100 under 10.

Howard had the merit of drawing attention to the miseries of prisons—but he was a severe disciplinarian, and the promoter of the climax of human oppression by solitary confinement.

During the second 10 years of Geo. III., the capital punishments, in London, savoured of butchery. Every 6 weeks there used to be a public procession, from Newgate to Tyburn, of from 8 to 15 and 20 criminals, chiefly youths; and, at the drop of the Old Bailey, the executions used to be likened to the suspension of pounds of candles, 15 or 20 at a time.

In England, in 1836, the charges of murder were 73; in Ireland, 340; and, in Scotland, 16.

The attempts to murder were 118 in England and Wales; 192 in Ireland; and 12 in Scotland.

The manslaughters were 201 in England and Wales; 280 in Ireland; and 26 in Scotland.

The London police took into custody, in 1837, no less than 64,416 persons, of whom 21,426 were for drunkenness, 5026 for assaults, 7659 disorderly, 1634 suspicious, 4287 vagrants, 3103 prostitutes, and 921 reputed thieves; the remaining 26,560 being for various penal offences. Of the whole, 28,500 could neither read nor write.

No less than 4578 convicts for petty offences, and mostly for 7 years, were sent, per annum, in the 10 years down to 1833, to Australia. Six to one were males.

In 1834, 99,780 persons were confined in the gaols of England and Wales; and, as crime is on the increase, owing to the poor-laws, they have not since been less.

Of the 23,612 criminal prosecutions, in 1837, no less than 17,087 were convicted, being a considerable increase. The largest proportion, per county, was Somerset, 1 in 393; and Warwick, 1 in 382; all England and Wales, 1 in 588. The sentences of death were 438; transportation for life, 636; *eight* only were executed, all for murder. Of the whole, 36 in 100 were unable to read and write, and 52 in 100 imperfectly; *i. e.* 88 in 100 were uninstructed!

The commitments, in England and Wales, in 1838, were 23,094.

3052 were sentenced to transportation for life or to 7 years, in 1837! Life 886, and 7 years 2166. Ireland averages in transports 1000. Expences to Australia 15*l.* Six only were executed in 1837.—*Maule.*

Prison expences are 14*l.* to 24*l.* per annum. —*Ibid.*

The causes of the frightful and disgraceful disproportion of crime in England, where there is ten times the religious instruction, are the anti-social inequalities of property, and the increased facilities for increasing the proportion of reckless poverty; the difference in the size of farms in the two countries, the average in Britain being 220 acres, and in France but 60; and the absence of inexpensive amusements on Sunday evenings; the French population being at fêtes, rustic dances, &c. and the English in public-houses or gin-shops. Those who refer it to the low price of spirits, are not aware that, in France, one penny is the price of a glass of the best brandy, and 3*d.* the price of a quart of draught wine, or 5*d.* by the bottle. The causes are, the recklessness of families in England, ruined by the late monetary changes, and by commercial fluctuations, and the want of innocent amusements on the day of leisure.

The situation of convicts in New South Wales is so horrible, that jurors ought not lightly to convict, as implying *mere* transportation.

About 600 prisoners are confined in the Penitentiary at Milbank.

Keepers of the Peace were formerly chosen by the inhabitants of each county; but, by 34th Edw. III., a royal authority, or commission, was given to them.

Juvenile convicts are now removed to Parkhurst, in the Isle of Wight.

The 3 city prisons have cost the City of London full 20,000*l.* per annum.

The punishment of the gallies in France, &c. is cruel, insulting, and disgraceful to humanity. The victims are chained by the neck to a main chain, which unites 30, and few ever disengage themselves till suicide, disease, or crimes worthy death, relieve them. Their place of confinement and labour, at Toulon, is called the Bagne.

The Hindoos and Japanese still practice ordeal, and in very cruel forms.

TOPOGRAPHICAL.

The number of parishes, in England, is 9860; in Wales, 833; and, in Scotland, 948; respectively, in 42, 12, and 32 counties. In Ireland there are 32 counties, divided into 294 baronies.

Many of the counties of England are mentioned before the extinction of the Saxon Heptarchy; and, therefore, this division was not made by Alfred.

Distances of Towns from London —

Aberystwith	211	Liverpool	206
Alnwick	308	Lynn	102
Bagnor	236	Maidstone	34
Bath	106	Manchester	182
Bedford	50	Merthyr Tydvil	176
Birmingham	109	Milford	258
Brighton	51	Montgomery	168
Bristol	118	Newcastle-un.-li.	150
Buckingham	58	Ditto upon Tyne	274
Bury St. Edm.	71	Newmarket	61
Caermarthen	218	Northampton	66
Cambridge	50	Norwich	108
Carlisle	301	Nottingham	124
Chatham	30	Oakham	95
Chelmsford	29	Oxford	54
Cheltenham	94	Penzance	281
Chester	183	Peterborough	81
Chichester	62	Plymouth	216
Colchester	51	Poole	103
Coventry	91	Portsmouth	72
Croydon	9	Preston	217
Devizes	89	Ramsgate	71
Doncaster	162	Reading	38
Dorchester	119	Rochester	29
Dover	71	Salisbury	81
Dumfries	336	Scarborough	217
Edinburgh	395, 466	Sheffield	162
Exeter	171	Shrewsbury	153
Falmouth	269	Southampton	74
Gloucester	104	Stafford	141
Glasgow	396	Stamford	89
Guildford	29	Stratford	92
Halifax	197	Taunton	141
Hertford	21	Tenby	250
Holyhead	267	Tunbridge-Wells	36
Hull	174	Wells	120
Huntingdon	59	Weymouth	128
Ipswich	69	Whitehaven	294
Kendall	262	Winchester	62
Lancaster	214	Windsor	21
Leicester	96	Worcester	111
Leeds	189	Yarmouth	124
Lincoln	132	York	199

Every Hundred had 100 or 120 householders. Some Hundreds do not contain a sq. mile; and, in Lancashire, some 300. In Wales, they were called Cantrefs and Commots: in the northern counties they are called Wards and Wapentakes; in Kent, Lathes; and, in Sussex, Rapes.

The parishes were originally of the same extent as the manors, and the lord appointed the clergyman. In the north, parishes often contain 30 or 40 sq. miles.

From the Lizard to Dunnet, in Caithness, is 608 miles by the map, *i. e.* 8° 44½′ diff. lat., and 1° 44′ lon. From Rye to Cape Wrath is 58 miles. The greatest breadth from the Land's End to Lowestoffe is 367 miles.

The coasts of England present high cliffs only in Cornwall, Wales, Kent, and Norfolk.

The Antipodes of England lie to the south-east of New Zealand; and near the spot is a small island, called Antipodes Island.

Ireland is 3⅝ degrees of latitude, or 259 miles long, taken from Cork-head to Malin; and 2¼ degrees wide, or 155 miles wide, taken from Dublin to Ballynahinch.

In superfices, England and Wales are to France as 90 to 154; Turkey the same; to Spain as 90 to 137; to Prussia as 90 to 80; to Portugal as 29; and to Belgium as 10.

Corporate Towns are governed by a mayor and town-clerk, from 6 to 24 aldermen, and from 20 to 30 common-councilmen. They have also a recorder, and about 20 clerks and officers, besides gaoler, trumpeter, &c.

In 1839, a law was passed to put an end to the iniquitous system of imprisonment for debt on the first process of the plaintiff. Trial and judgment must now precede the option of the incarceration of the debtor. This law contains many harsh provisions after judgment; but, the principle being adopted, modifications may be expected.

Professor Cooper states, in his lectures on Political Economy, that in the affairs of life, neither individuals nor bodies are uniformly guided by just considerations for their own good. They decide under present temptations, from caprice, prejudice, flattery, or temporary excitements; often on unfounded likings, or dislikings, under imperfect apprehension, want of information, reflection, and consideration; while bodies constantly make decisions by majorities, under influence and authority, of which every individual would be personally ashamed.

It was a maxim of the government of Morocco, that, to rule people effectually, there should always be a stream of blood flowing from the throne. The punishments of these despots, according to their humour, are—to cause a culprit to be run through the body, strangled, beheaded, or cut in pieces, tied in a bag, and thrown into the sea, impaled on a stake, sawn asunder, burnt alive, suspended from iron hooks, thrown upon pikes, or dragged at the heels of a horse; and sometimes they bury alive, or cause four walls to be built round their victims.

Of 237 corporations in England, 212 have property. Their gross income is 367,000*l.*, and their expenditure 377,000*l.* 133 are in debt for 1,855,371*l.*, besides 4463*l.* annuities. 31 have not above 50*l.* 25 have from 750*l.* to 1500*l.* 9 have above 10,000*l.* 17 have no income.

Government and laws are commonly displayed by the pride of authority only, as a sort of vulgar Raw-head and Bloody-bones! Their means are coercion and punishment, and the people know them only by these and their exactions. It would be a novelty to see Power address itself to the affections, and laws made in a spirit of kindness, to promote and reward virtue.

In a valley, 36 by 30 miles, surrounded by impassable Pyrenees, lies the independent republic to Andorra. It is a society under patriarchal family control, with representative legislation, but without civilization, or domestic comforts; and its only art is the forging of iron. Priestcraft and superstition govern every thing.

Criminal Jurisprudence is in the lowest state in Germany. The untried are treated cruelly, and the trials demand confession as part of the procedure, and even preliminary to punishment—the alternative being a loathsome solitary dungeon, so that false confessions are often made, to escape from them even by death.

A sight of a transcript of any will may be had at Doctors' Commons for 1*s.*, but nothing must be extracted from it, or compared with it, without paying for a copy or extract.

The Norwegian parliament is called the *Stor*thing. One quarter is selected from a second chamber called *Loa*thing, and the 3-4ths are called the *Odels*thing.

The free cities, in the time of the Romans, were, Camulodonum (Maldon), Eboracum (York), Lindum (Lincoln), Wintonia (Winchester), Cestria (Chester), Sorbiodunam (Sarum), Londinium (London), and Verulameum (St. Alban's).

The law of primogeniture is the great curse of British society. It enables property to accumulate by heirship faster than by industry; it generates a race of spoiled children of fortune, and simultaneous races of proud beggars.

Twelve persons, assembled for an unlawful purpose, constitute a riotous assembly.

The *Posse Comitatus* is the whole male population, called out by the sheriffs or two justices; and all not attending are liable to be imprisoned.

A Feod, or feud, was a grant of land to a vassal, on condition to the lord, as for military service, &c. This service for land was the feudal system.

Taxes on law proceedings are a denial of justice to all who are not rich, and a premium on oppression and immorality.

The London Police, or *gens d'armerie*, are 3415 in number, and their cost about 210,000*l.*

Villeins, or farm-labourers, were sold for slaves till the reign of Edward I. The markets were glutted with them, and Ireland and Scotland were cultivated by them.

A Hindoo jury, agreeable to ancient custom, consists of 5 persons, chosen from among the elders; 2 by the plaintiff, 2 by the defendant, and the 5th by the administrator of justice.

In 12 years, from 1820 to 1832, 49,500 persons were discharged under the insolvent act.

By the custom of gavel-kind, in parts of Kent, an estate is divided among all the sons, and that of an intestate brother, among his brothers.

None but vain sovereigns add to the splendour of palaces, before cottages are made comfortable. These ought to be regarded as the porticoes of palaces.

The English champions of civil liberty, since its object has been understood, were—Hampden, Pym, Fairfax, Hollis, Coke, Vane, Ludlow, Lilburn, Milton, Sidney, Russell, Marvel, Fletcher before the Revolution; and since, Locke, Burnet, Swift, Holt, Shippen, Glover, Chatham, Wilkes, Camden, Erskine, Sawbridge, Fox, Sheridan, Whitbread, Paine, Priestley, Price, Tooke, Stanhope, Perry, Belsham, Romilly, Cobbett, Wakefield, and Cartwright.

The best Reading Histories of England are those of Rapin, Hume, Smollett, Henry, Coote, and Lingard. Portions are Clarendon, Turner, Hallam, Belsham, Burnet, Ludlow, Lyttleton, and Spelman. The best for elementary study is Goldsmith's *Grammar* of British History, and Robinson's Abridgment of Hume and Smollett.

Forms of Government of the States of Europe.

Andorra, Pyrenees, *Republic*, ...	With two syndics and a council.
Anhalt-Bernburg, *Duchy*, ...	States having limited powers.
Anhalt-Cothen, *do.*	Do do.
Anhalt-Dessau, *do.*	Do. do.
Austria, *Empire*, ...	Absolute monarchy except Hungary, &c.
Baden, *Grand Duchy*, ...	Limited sovereignty;—two chambers.
Bavaria, *Kingdom*, ...	Limited monarchy;—two chambers.
Belgium, *do.*	Do. do.
Bremen, *Free City*, ...	Republic;—senate and convention.
Brunswick, *Duchy*, ...	Limited sovereignty;—one chamber.
Church, States of, *Popedom*, ...	Absolute elective sovereignty.
Cracow, *Republic*, ...	Senate and chamber of representatives.
Denmark, *Kingdom*, ...	Absolute monarchy;—with provincial states.
France, *do.*	Limited monarchy;—two chambers.
Frankfort, *Free City*, ...	Republic;—senate and legislative body.
Great Britain, *Kingdom*, ...	Limited monarchy;—lords and commons.
Greece, *do.*	Absolute monarchy.
Hamburg, *Free City*, ...	Republic;—senate and common-council.
Hanover, *Kingdom*, ...	Limited monarchy;—two chambers.
Hesse-Cassel, *Electorate*, ...	Limited sovereignty;—one chamber.
Hesse-Darmstadt, *Grand Duchy*, ...	Limited sovereignty;—two chambers.
Hesse-Homburg, *Landgraviate*, ...	Absolute sovereignty.
Hohenzollern-Hechingen, *Principality*, ..	Limited;—one chamber.
Hohenzollern-Sigmaringen, *do.* ..	Do. do.
Holland, with Luxemburg, ...	Limited monarchy;—two chambers.
Ionian Islands, *Republic*, ...	Under Br. protection;—council & chamber.
Lichtenstein, *Principality*, ...	Limited monarchy, with one chamber.
Lippe-Detmold, *do.*	Do. do.
Lubeck, *Free City*, ...	Republic;—senate and common council.
Lucca, *Duchy*, ...	Limited sovereignty, with one chamber.
Mecklenburg-Schwerin, *Grand Duchy*, ..	Limited monarchy, with one chamber.
Mecklenburg-Strelitz, *do.*	Do. do.
Modena and Massa, *Duchy*, ...	Absolute sovereignty.
Monaco, *Principality*, ...	Do. do.
Nassau, *Duchy*, ...	Limited sovereignty;—two chambers.
Oldenburg, *Grand Duchy*, ...	Absolute sovereignty,
Parma, *Duchy*, ...	Do. do.
Portugal, *Kingdom*, ...	Limited monarchy;—1 chamber of repres.
Prussia, *do.*	Absolute monarchy;—provincial States.
Reus, *Principalities of*, ...	Limited sovereignty;—one chamber.
Russia, *Empire*, ...	Absolute monarchy,
San Marino, *Republic*, ...	Senate and council of ancients.
Sardinia, *Kingdom*, ...	Absolute monarchy.
Saxony, *do.*	Limited monarchy;—two chambers.
Saxe-Altenburg, *Duchy*, ...	Limited monarchy;—one chamber.
Saxe-Coburg and Gotha, *do.*	Do. do. do.
Saxe-Meiningin-Hildburgen, *do.*	Limited monarchy;—one chamber.
Saxe-Weimar-Eisenach, *do.*	Do. do. do.
Schwartzburg, *Principalities of*, ...	Limited monarchy;—one chamber.
Schauenburg-Lippe, *Principality*, ...	Do. do. do.

Sicilies, The Two, *Kingdoms*,	..	..	Limited monarchy, with a council.
Spain, *do.*	..	..	Limited monarchy, with a legislature.
Sweden and Norway, *do.*	..	..	Limited monarchy, with a diet and storthing.
Switzerland, *Republic*,	..	..	Confederation of republics;—a diet.
Turkey, *Empire*,	..	..	Absolute monarchy.
Tuscany, *Grand Duchy*,	..	..	Absolute sovereignty.
Waldeck, *Principality*,	..	..	Limited sovereignty;—one chamber.
Wurtemburg, *Kingdom*,	..	..	Limited monarchy;—two chambers.

NAVAL AND MILITARY.

In a Roman army, the first line were *Hastati*, or young men; the second, *Principes*, or middle-aged; and the third, *Triarii*, or veterans. The light troops, for skirmishing, were called *Velites*. The latter had bows and slings, and seven javelins. The former a two-edged sword, buckler, and helmet.

A Roman legion consisted of 6000 men, divided in 10 cohorts, and every cohort into 6 centuries, with a vexilum, or standard, guarded by 10 men.

Attached to every Roman legion was an ala of 300 horse in 10 turmæ. The commander of the legion was a prefectus; of the cohorts, a tribune; and of the centuries, a centurion. The standard was a silver eagle, on the top of a spear.

Among the early Romans, commanders of armies were called *Imperatores*, but when Cæsar became emperor, the commanders were called dukes, or lieutenants of provinces.

The Greeks and Romans had no standing armies in time of peace. In war, every citizen was a soldier.

The Greek phalanx consisted of 8000 men in a square battalion, with shields joined, and spears crossing each other.

The Macedonian phalanx were 61 deep, with shields joined.

Ancient soldiers were trained to fight with either hand.

The Roman camp was a square; one part for officers, and one for privates.

Battering-rams were from 60 to 100 feet long, and worked by 40 or 50 men, continually relieved. The largest battering-rams of the ancients were equal in force to a 36-lb. shot from a cannon.

The Ægis of the ancients was the breast-plate, or modern cuirass.

The balista discharged stones, and the catapulta arrows. They were equivalent to artillery, threw arrows half a mile, and stones of 200 or 300 lbs weight.

The shield, the breast-plate or gorget, was extended to the body and limbs, as armour, and the helmet protected the head. The most savage tribes use shields, and often helmets. Shields were usually made of leather, but often of wood or metal. The Grecian was round, the Roman square. The helmet was provided with a vizor, to raise above the eye, and a beaver, to lower for eating. The vizor, with grated bars, is used in the arms of nobility; the elevation, without bars, a knight; and the vizor, closed, an esquire. The armour, for the arms and shoulders, was called the *vambrace* and pouldron; for the thighs and legs, *cuises* and greaves; and, for the hands, *gauntlets*. Knights wore golden spurs; squires, silver ones. The armour, or mail, was called *chain*, if made of scales, or net-work; or *plate*, if in small metal pieces. The Saxons and Normans used long spears. The Greeks threw theirs. Spears were 6 yards long, and pikes 14 or 15 feet. Maces were originally clubs, used by cavalry, and fixed in their saddles. The Roman swords were from 20 to 30 inches. The broad-sword and scymetar has lately been adopted.

The habergeon, or coat of mail, was made of plate, or scales of iron, or of chain in rings.

The power of a bow is as the distance it is drawn from its inert position.

The English long-bow was the heighth of the archer, and made of yew, hazel, ash, or hawthorn. The cross-bow had the arrow in a solid groove, and was clumsy. The long-bow was straight, and its arrows longer than half, or the radius. Targets were, at least, a furlong distant, but at present 200 yards. A strong man can draw 27 inches, but Robin Hood's arrows were a cloth yard, or ell of 45 inches, and his bow, (lately in possession of Sir G. Armitage) 6 feet. 300 yards is a good shot, but nearly 600 have been performed, and Hood's songs claim for their hero, and John Nailor, 7 feet high, a North country mile, or 2000 yards! Four arrows can be discharged in the time of loading a musket. The arrow was of yew, and pointed with iron and steel. The feathers were 3, and 1 grey to guide the eye. A sheaf was 24. Sometimes they bore combustibles. They would pass through a seasoned deal-board an inch thick. Every archer carried a pike and dagger, for close action, and he fixed the pike in the ground. His left arm was protected against the recoil of the string by a leather bracer. The bow was well notched, the middle of the bow waxed, and a spare string in reserve fitted the archer for action.

Coats of mail, or habergeon, were shirts of interlaced rings, to protect the body from thrusts and cuts.

A Roman legion was ten cohorts of 600 men each, with a wing of 300 horse.

Ships of war were, by the Romans, called *naves longæ*; merchantmen, *oneraria*; and light vessels, *actuariæ*

The Pacha of Egypt has 12 sail of the line, and 14 frigates; 3 or 4 are first-rates, carrying 150 guns.

There are two regiments called life-guards, 1 royal horse-guards, 7 of dragoon-guards, and 17 of dragoons; of which, 4 are lancers and 3 hussars. In infantry, 3 foot-guards and 99 of the line; also, a rifle-brigade, a

royal staff corps, 2 West India, 1 Ceylon, 1 African, 1 mounted rifle, 1 Newfoundland, and 1 Malta.

Chelsea Hospital is under a governor, lieutenant-major, and adjutant; treasurer, comptroller, steward, and about 60 clerks and assistants.

There are 33 garrisoned places in Great Britain, as towns or castles, 11 in Ireland, and 9 in the colonies. There are also 3 military asylums, and 2 military colleges, in England; and 1 in Ireland.

The corps of Engineers has a colonel-in-chief, and a second, 5 colonel-commandants, and 11 colonels.

The Royal Artillery consists of 3 field-officers, 10 colonel-commandants, and 20 colonels.

In the British land-service, the adjutant-general directs all matters of discipline; the quarter-master-general gives orders for marching and quarters; the barrack-master-general manages the barracks; the commissary-general the provisions and stores; the paymaster-general superintends pay and accounts; while the master-general of the ordnance directs the arms, ammunition, depôts, &c.

The price of commissions in the army is, in the cavalry, lieutenant colonel, 6176*l.*; major, 4575*l.*; captain, 3 25*l.*; lieutenant, 1190*l.*; and cornet, 840*l.* In the infantry, lieutenant-colonel, 4500*l.*; major, 3200*l.*; captain, 1800*l.*; lieutenant, 7 0*l.*; ensign, 450*l.* The horse guards are 25 per cent. higher, and the foot-guards double.

At Woolwich there is a military academy, a laboratory, an artillery depôt, a carriage department, and a grand repository.

The ORDNANCE is managed by a master-general, lieutenant-general, surveyor-general, clerk, store-keeper, clerk of deliveries, treasurer, secretary to the master-general, and chief secretary, with about 160 clerks; and, under this board, is the academy and laboratory at Woolwich; with minor establishments at 35 places in Great Britain, and 31 in the colonies. Each have a store-keeper, deputy, and clerk.

Previously to Charles II., the only armed force was the 100 yeomen of the guard; and he established, on a foreign model, two regiments of guards. Previously to Henry VII. there were not any yeomen of the guard.

An iron 42-pounder is 10 feet long, and weighs 67 cwt.; 32 and 24-pounders are the same length, but lighter; 18, 12, and 9-pounders are 4 inches shorter, and the 9-pounder weighs but 30 cwt., taking a charge of 3 lbs. of powder, and the diameter of the shot being four inches. In the merchants'-service, 9-pounders are 5 feet long, and weigh but 14 cwt.

The English light brass 6-pounder is 5 ft., and weighs 6 cwt., with 3·668 inches calibre, and vent 2·12; 9, 6, and 3-pounders are 17 calibres long; and 24 and 18-pounders are 13 calibres; a 24-pounder is 6 feet long, with 3·669 inches calibre and weighs 24 cwt.; the 18-pounder weighs 18 cwt., and so down. The 42-pounder weighs 66 cwt., is 16·244 inches calibre, and 9½ feet long; 24 pound iron guns weigh from 31 to 50 cwt., and are from 6½ to 9½ feet long; 24-pound carronades are 5·68 bore, 7 feet long, and weigh 12 cwt.

Cast-iron cannon are used in the navy. Brass cannon droop by much firing.

Robins says, that no field-piece should be loaded with more powder than a fifth or sixth of the weight of its ball; nor any battering-piece with more than a third.

The velocity of the explosion of gunpowder, fired alone from a cannon, is 7000 feet per second; and, at the moment of explosion, four times greater. Cannon-balls go farthest at an elevation of 30°, and less as the ball is less.

13-inch mortars range 2¼ miles, and weigh 82 cwt.; are 5 feet 3 inches long, and take a charge of from 20 to 30 pounds of powder; 10-inch range 2 miles; and 8-inch 1 mile, 2 feet 1 inch long, with 2 lbs. 2 oz. of powder; 13-inch, in the land-service, are 3 feet 8 inches long, with 9 lbs. 1 oz. of powder; 68-pound shot are 8 inches in diameter, with 9 lbs of powder, and bore 4 inches; a 13-inch shell weighs 198 lbs., and is charged with 6½ lbs. of powder.

The Shrapnel shell is a bomb filled with balls, and a lighted fusée to make it explode before it reaches the enemy, when the bullets separate, and proceed as before.

The range of carcasses is about two miles, and those of 13-inch diameter require about 30 lbs. of powder.

Rifle-barrels make the ball pass through a screw, formed in the length of the barrel, by which the velocity, at exit, is increased, and the aim more true.

Perkins' steam-artillery is to throw 60 balls, of 4 lbs., per minute; and from 100 to 1000 musket-balls per minute.

The armies of different nations are nearly as follow, in a state of peace, in 1838:—

United Kingdom	95,000
France	310,000
Austria	270 000
Prussia	165,000
Switzerland	32,000
Bavaria	35,000
Sardinia	25,000
Portugal	35,000
Naples	30,000
Spain	50,000
Sweden	45,000
Denmark	38,000
Russia	650,000
Turkey	200,000
Egypt	150,000
East India Company	200 000
China	1,200 000
Japan	120,000
Sikhs, confederacy	200,000
Morocco	40,000
U. States (200,000 militia)	6,000
South American Republics	40,000

At Midsummer, last year, there were, in the British army, 4 field-marshals, 442 generals, lieutenant-generals, and major-generals, 357 colonels, 689 lieutenant-colonels, and 696 majors, besides 123 retired. The army itself

consisted of 26 regiments of cavalry, 99 of infantry, and 7 foreign and colonial regiments.

The British army, in 1839, consists of,—

Cavalry	6,200
Ditto, India...........	3,506
Infantry	73,334
Ditto, India...........	17,735
Officers	5,681
Non-commissioned	7,868
Charge	£4,527 020
Less, E. I. Company	714,692
Pensioners........	70,371
Half-pay	4,803
Cost	28,387,486

A memorable revolution took place, in 1838, in Western Asia. The Egyptian army under Ibrahim, for Mohammed Ali, has utterly routed the great Turkish army, near Aleppo, 600 miles from Cairo, and from Constantinople. The crisis was remarkable; Sultan Mahmoud, who had prepared the Turkish expedition, died at Constantinople but a few days before the conflict, leaving a minor successor, and an empire in disorder.

Second-rate ships are from 80 to 100 guns on two decks, with a complement of 700 men; third-rates have 74 guns, and 650 men; fourth-rates 50 or 60 guns, and 400 men.

The above are called ships of the line.

The fifth and sixth-rates are frigates, from 24 to 48 guns.

Our best ships are built after French models, the French being the most scientific ship-builders.

An improved 50 gun ship, 32-pounders, is 2000 tons, 183 feet long, 176 feet high from keel to deck, and 52 feet broad.

The Rodney, of 92 32-pounders, is in length 243½ feet, and in breadth 52 feet 2 inches, tonnage 2598.

To build a 74-gun ship requires 18 men for three years, or 54 men for one year.

There are five naval stations, or commands, in the British Seas, and seven in the colonies.

The cavalry and infantry of the British army, in 1838-9, are 89,305 men, over and above the East Indian army. There are, also, 8600 artillery, and 34,000 seamen and marines.

Austria announces a military force, in 1839, of 744,000 men; Prussia of 440,000; and the German confederation of 222,000.

Russia, at the same time, announces a force of 1,020,000 men of all arms, besides 36 sail of the line, and 50 frigates.

The Swedish regulars are but 5900 men, and the militia 26,914. The artillery is 2700.

France, in peace, has 310,000 men, and 418 generals.

Austria, in peace, has 272,000 soldiers, and 364 generals.

Prussia, in peace, 120,000, and 81 generals.

Malte Brun estimates Hesse as 1 soldier to every 49 inhabitants; Prussia, to 68; Russia, to 90; Austria, to 100; France, to 110; England, to 140; and the Italian powers, 8 to 220.

A battalion of 500 has a colonel, lieutenant-colonel, major, 10 captains, 12 lieutenants, 8 ensigns, an adjutant, quarter-master, pay-master, surgeon and mate, 32 serjeants, 30 corporals, and 21 drummers.

A regiment of horse-soldiers, of about 360, officers and men, costs about 25,000*l.* per annum.

The enrolled English militia are 51,357, and the Irish 18,725, with about 2200 officers.

The gunpowder depôts are at Waltham Abbey, Hyde Park, Purfleet, Gravesend, Tilbury, Upnor, Priddey's Head, Tipner Point, Keyham Point, Tynemouth, and Marchwood.

The 6640 men in the guards cost 45*l.* 7*s.* 4*d.* per man per annum, and other soldiers 42*l.* 7*s.* 3*d.* each.

Barracks for 800 infantry cost about 37,000*l.* For 1200 infantry and 400 cavalry, 60,000*l.*

The British native army in India is, 24,515 in Bengal; 56,295 at Madras; and 30,802 at Bombay; besides 4000 artillery, and 6000 European officers.

There is a Volunteer Regiment of Infantry in London, called the *Hon. Artillery Company*, which, upon all occasions of commotion, is in aid of the civil power of the city. It consists, mostly, of respectable citizens, who equip and support themselves at their own expence. Their head-quarters are in the City-road, where they have a handsome establishment. It is a very ancient corps: as far back as Henry VIII.

Flying horse-artillery consist of light guns and howitzers, for use where wanted in battle, or to attend cavalry in rapid evolutions.

Vossius maintains that cannon was invented in China, in the reign of Kitey, in the year 85.

Cannon were used at Quesnoy, or Cressy, perhaps before, and called *bumbards*.

The largest known piece of ordnance is of brass, cast in 1685, at Beijapour, by Aulem Geer. It is 14 feet 1 inch long, and 28 inches bore, and equal to a ball of 2600 lbs.

The famous floating-batteries with which Gibraltar was attacked in 1782, were the scheme of D'Arçon, a French engineer. There were ten of them, and they resisted the heaviest shells and 32-pound shot, but ultimately yielded to red-hot shot.

In modern tactics, the hollow square is preferred to the solid squares of the ancients, when infantry are attacked by cavalry.

There are on the Kentish coast 27 Martello Towers, as defence to the military canal.

The British army, during the years of peace, 1783 to 1792, was from 30,276 to 39,253 men. The peace establishment, in the year 1826, was 149,000; in 1830, 88,500; and, in 1839, 99,000.

The first regiment, armed with muskets, was formed by Colonel Thomas, in the Low Countries, in the age of Elizabeth.

Till 1750, our regiments were only called after their colonels. In 1782, to assist recruiting, many were called after counties. The Scots Royals are the oldest regiment, and formed in the reign of Charles I. The Coldstream Guards were formed by Monk, in 1660. The 2d, or Queen's Royals, was

formed out of the four regiments sent to hold Tangiers, and called Kirk's lambs.

The parade step is 75 to 95 per minute. The quick march 108 to 115. The storming step 120.

Moralists and civilians deplore the slaughters in battles, but military men never; since the survivors, (and all hope to survive,) consider the killed and wounded as so many removed out of the way of their promotion It is a lottery, in which the blanks are *death;* but every adventurer looks only to the prizes.

Glory in war is derived solely from the justice of the war. Those who are victorious in an unjust war have no higher glory than appertains to the success of a banditti. But this discrimination is not always made either by contemporaries or historians, and kings and courts confer meretricious distinctions on their successful generals, to excite them and to gloss over the injustice of the cause.

To carry on the wars of the past century, the currency was depreciated; paper-money was increased, and the circulation, from a few millions in 1688, to fifty millions in 1815, besides inland bills and notes, for 4 or 500 millions. By this means, the taxes, of less than two millions at the Revolution, were increased to seventy millions in 1815, and the annual public expences from 3 to 130 millions.

England, in the scale of nations, was a secondary power till 1763. The conquest of Canada and the establishments in India, her naval superiority, her colonies, and her trade, raised her then to the first rank among nations. She suffered a deep blow, by the separation of the American colonies, and the expences of the war; but, in 1792, she had re-attained the summit of internal prosperity and foreign ascendancy. The war against the French Revolution then employed, for 23 years, all the resources of the kingdom, and exhausted them. The real property was mortgaged by and for the government, and money was artificially lowered in value by paper, as 4 to 1.

Military officers die 3·12 per cent. in Bengal; 4·49 per cent. at Madras; and 3·94 at Bombay.

The Prussian military system is light and effective. An annual conscription extends to every class, from 21 to 26 years of age, and 3 years is the period of service, except in the artillery, 5 years. They then belong to the Landwher, or National Militia, and are called out 10 or 12 days in the year.—*Gleig.*

The military expenditure on colonial account is 2 millions; the civil, half a million; and the naval, directly and indirectly, another half million, in all 3 millions.

5000 British fell at the storming of Badajoz, and 4000 at St. Sebastian.

Fort William is the most regular fortress in India, but so large as to require the defence of 8 or 10,000 men.

5000 military, and 1000 naval cadets, are always under education in Russia. There are 550,000 infantry, 95,000 cavalry, 50,000 artillery, and 90,000 cossacks, &c. The navy is 54 of the line, and 35 frigates.

Five-sixths of the Dutch troops die in their passage to Java, and in seasoning.

Armies employ the idle, dissolute, and reckless. Among officers, the chance of promotion by survivorship, compensates for the chance of being killed; and, hence, battles, &c., so revolting in a moral sense, are to them desirable.

Victorious generals are created by success in 2 or 3 rencontres. Confidence is thus given to troops, and other victories beget the false renown of a conqueror.

Victory is the consequence of discipline, if strong enough to render troops indifferent to the direct assaults of an enemy till worn out. Other victories, as those of Cromwell, Charles XII., and Napoleon, were gained by pushing through the enemy's centre, and dividing and distracting the whole.

In partizan wars, more is effected by bribery than the sword. The longest purse generally succeeds, for treachery is engendered by shades of opinion. Thus, in 1815, the French were Napoleonists, Republicans, or Bourbonists, so that when Napoleon took the field on June 15, 1815, the generals and officers had been so tampered with, that some of his generals went over to the foreign enemy on the 16th, and several movements were baffled by unseen causes. Ney was too late at Quatre Bras, and too forward at Waterloo, Erlon, with the centre, marched and countermarched a whole day, while right or left needed his aid; and Grouchy and Vandamme, the right wing on the 18th, did not fire a shot. While the Allies (double the number of the engaged French,) acted in concert, and the route of the French left and centre was effected by flank movements of the very troops to which Grouchy was opposed.

Napoleon's plan, in June, 1815, was to prevent the union of the Allies. The Prussians lay to the right, and the other Allies to the left, and other large Prussian corps were in advance. On the 15th and 16th he drove all before him, as a wedge in the centre; but, on the 17th, he allowed the English, Dutch, &c., to rally and unite at Waterloo; and though the Prussians were but a few hours from the field, he postponed the attack till after noon. As usual, he carried the position; but, in the moment of victory, 40,000 Prussians joined, and his situation became critical. At 8, other 10,000 Prussian cavalry, from Wavre, galloped through the valley, and struck the French with a panic, so that they fled in confusion to Charleroi. The Prussians claim the victory, and assert that they converted a defeat into a victory; but the right wing of the Allies, under Wellington, also claim it. About 36 or 40,000 of the Allies were killed and wounded, including 20 generals, and it is supposed, as many of French, but no general killed. The Prussians, in their advances, took 5 or 6000 prisoners.

The number of *Chelsea* pensioners, lately,

were 84,940, at a cost of 1,387,169*l.* The *Greenwich*, 19,489, cost 252,563*l.*

There are 100 companies of marines; 26 at Chatham, 29 Portsmouth, 27 Plymouth, and 18 Woolwich! with about 1000 officers.

Greenwich Hospital has a governor and lieutenant, also 5 captains, and 8 lieutenants, with about 60 clerks, medical assistants, &c. It has estates in the three northern counties, and valuable schools, with 10 masters and mistresses.

There are 2 schools of 400 boys each, and 200 girls at Greenwich, for children of seamen. There is also a Royal Naval College, at Portsmouth.

An admiral carries his flag on the main-top-mast, a vice-admiral on the fore-top-mast, and a rear-admiral on the mizen-top.

Pensions for wounds and widows are provided by stopping 3*d.* in the pound from all payments to officers, and by rating every 100 men as 101. This yields to widows from 120*l.* to 5*l.* per annum; and, for wounds, from 20*l.* to 4*l.* Both eyes being reckoned at 20*l.* a year, one eye at 6*l.*, an arm from 30*l.* to 14*l.*, and a leg from 14*l.* to 12*l.*

A lieutenant in the navy ranks as a captain in the army; a post-captain as colonel; and an admiral as general.

Below the lieutenants are warrant-officers, as master, second master, boatswain, and carpenter; also chaplain, surgeon, mate, and purser. The petty officers are master's mates and midshipmen.

The master has charge of all the ship's materiel. The gunner of the ordnance, &c. The boatswain superintends the stores, &c. The carpenter watches the soundness of every part. The purser manages the provisions.

In the time of Henry VIII. the royal navy consisted of 1 ship of 1500 tons, 2 of 800 tons, 3 of 600 tons, 3 of 400 tons, and 6 or 7 smaller. The largest was called the Great Harry. At his death, the royal navy was extended to 50 ships, making 12,000 tons, manned by 8000 sailors and soldiers. Elizabeth's fleet, in 1588, consisted of 176 ships, with 15,000 men, 40 of which were of the royal navy, and 2 of a thousand tons. The Prince Royal, built in 1610, was 1400 tons, and had 64 guns. In 1637, the Sovereign of the Seas was launched, of 1600 tons, and pierced for 86 guns. In 1679, the navy consisted of 76 ships of the line; and, at the revolution, 173 ships of all sizes. At the death of George II. it consisted of 412 ships, measuring 321,000 tons. In the last war, there were in commission from 100 to 106 ships of the line, from 130 to 160 frigates, and 200 sloops of war; besides smaller vessels, amounting to another 500, and measuring between 800,000 and 900,000 tons.

Henry VIII. established the dock yard at Woolwich, and a separate Royal Navy. Besides the *Great Harry*, he had the *Regent* of 1000 tons, and 650 men, and the *Henry Grace de Dieu*, with 3 tiers of guns, 4 masts, and very lofty poops and forecastles. Elizabeth's largest ship was the *Triumph* of 1000 tons, 60 guns, and 780 men. King James built the *Prince*, of 1400 tons; and Charles I. the *Sovereign of the Seas*, of 1600 tons.

First-rates are now 2500 and 2600 tons. The Caledonia, of 120 guns, and 2616 tons, is 205 feet long, 53 broad, and 23 feet in the hold. The French Commerce de Marseilles was 208 feet long, and 2747 tons.

Several steam-frigates have been built by the French, with four boilers, each of 60-horse power, and provided with covers for the paddles, ball-proof. Other nations, with great activity, are doing the same, and *steam-power* will, unquestionably, effect great changes in naval tactics and warfare.

The different NAVIES are nearly as under, by some accounts:—

	Line.	Frig.	Smaller.
United Kingdom	120	130	307
France	54	65	213
Austria	3	8	61
Holland	18	26	50
Spain	15	18	40
Portugal	4	6	40
Sweden	13	15	60
Denmark	5	8	20
Russia	50	36	60
United States	18	16	40

The Pennsylvania, an American man-of-war, is 225 feet long by 58 broad, burthen 3000 tons, crew 1200, with 140 32-pounders. Her largest anchor is 5 tons, and her draught 28 feet. She could carry 30,000 barrels of flour, the consumption 15,000 for a year.

Total of 20 years' expences for building public ships	18,721,551
Repairs	11,037,188
Ordinary repairs for wear and tear	6,412,592
	£36,171,331

The annual demand of timber for the royal navy, in war, is 60,000 loads, or 40,000 full-grown trees, a ton each, of which 35 will stand on an acre. In peace 32,000 tons, or 48,000 loads. A 74-gun ship consumes 3000 loads, or 2000 tons or trees, the produce of 57 acres in a century. Hence, the whole navy consumes 102,600 acres, and 1026 per annum.—*Allnut.*

But, as five oak-trees yield a load and a half, so the navy may demand half a million of acres, or the produce of 5000 per annum.

Teak is preferred to oak, as more durable and less liable to splinter; and ships-of-war of this timber are building at Bombay and Port Jackson. Larch is recommended. At 70 years it is full grown; and a tree of 79 years was 102 feet high, and 12 feet girth, with 253 cubic feet. Another, of 80 years, was 90 feet and 17 feet, and 300 cubic feet, or 6 loads.

None can be pressed into the king's naval service above 55, nor under 18. No apprentices, nor landsmen who have not served at sea for 3 or 2 years. No masters of merchant-ships, first mates of 50 tons, and boatswains and carpenters of 100 tons. No men employed by the public boards, and none, except by an officer, with a press-warrant. The system is an exception to the rule of

social right. The public want the services of persons subject to impress, and yet decline to pay such bounties and wages as should tempt men to become volunteers. If bounties and wages in the king's service were equal to those in the merchant's service, the royal navy would be manned with volunteers, and half the irksome discipline of the navy would be unnecessary.

Persons enlisting as soldiers or sailors are not to be sworn in before a magistrate in less than 24 hours, and then are at liberty to dissent, on returning the enlisting, or bounty-money, and 20*s*.

Foreign seamen, after two years' service in any British ships, are naturalized.

During the late war, the number of seamen and marines was 150,000. The sums voted for the navy were 18 millions; and the waste was enormous.

The naval signals, by telegraph, enable 400 previously-concerted sentences to be transmitted from ship to ship by varying the combinations of two revolving crosses; and, also, to spell any particular words, letter by letter.

In a British Admiral's cabin there is no furniture for shew, and the apartment is as fully provided with cannon as the gun-decks. *Dupin.*

The Russians have a dock-yard at Nicolaief, in the Black Sea, and a fleet of 13 or 14 sail of the line, 8 or 10 frigates, and as many more small-armed ships.

The average duration of ships built of ordinary timber is, seven, eight, and ten years; but, if dry-rot were prevented, and the ships subject only to ordinary casualties, thirty years would be their average duration.

The English navy dock-yards cover about 500 acres. Portsmouth, 100; Plymouth, 96; Pembroke, 60; Chatham, 90; Sheerness, 60; Woolwich, 36; and Deptford, 30.

In 1835, there were 120 ships of the line in ordinary; in 1793, 141; and, in 1821, 160. The shipwrights, in the royal dock-yards, vary from 4000 to 2500.

The last war employed 700 transports of 300 tons.

The annual average of timber for the Navy costs, for building	748,723
For repairs	441,890
Total......	£1,190,613

In years of war it was half a million more.

THE ANCIENT MYTHOLOGY.

The Mythology which the Romans and other ancients adopted from the Greeks, and their poets and priests, is so remarkable for the grossness of its absurdity, that every rational person feels shame and astonishment that it should be taught in modern schools as a branch of knowledge.

The absurdities do not, however, originate with the first invention; but, in the ignorance and fancies of the commentators. The gods and goddesses, major and minor, were of Phœnician and Phrygian invention and growth, with some Egyptian varieties. They were, originally, *real personages* disguised, in prolonged time, by priestcraft, poetry, fable, and allegory.

Perhaps Taautus, the minister of Chronus, who wrote Ten Books of Laws, and who was a mystic in philosophy, laid the first rude basis of the system, by conferring sacerdotal character on Chronus and certain members of his family; and then, in progressive ages, the system spread to all the major and minor deities.

Another auxiliary was the *naming of the planets* after the same personages, by which they became associated with a science universally credited, and with the good and ill fortunes of mankind. This connection was irresistible, and the science of astrology being universal, worship and rites became coeval with faith in the celestial influences.

This was Phœnician and Egyptian; and, as the Greeks, &c. were colonists, the elder systems were decorated by the Greek fabulists, priests, and poets, till there was generated the mass of incongruous nonsense, since known as the Greek mythology.

Of course, in conferring names, the languages of Phœnicia, Egypt, and Greece, were intermingled; and, hence, the very same personages got different names; and, in time, such confusion arose, that it became sacrilege to attempt to unravel it!

Our only present method is to go back to the earliest records, and these are presented by Sanchoniatho and Manetho. What has since been added, is amusing for its folly, whether added by Greeks or Romans; but, the essentials are only to be found in records anterior to the jargon of Hesiod, Homer, Sappho, Ovid, Virgil, &c., &c., the oldest of whom lived 1800 years after Chronus and Taautus.

In this sense, mythology became the basis of the arts of recording, and the priesthood from their foundation became, by various arts, first recorders of great natural and political events. It was like all human practices, a step-by-step affair, which the imagination may follow. It was the very same with the sacerdotal characters, the modes of reverence, worship, &c., as in open spaces, woods, groves, temples, &c. &c.

The explanation of the hieroglyphics, with Sanchoniatho and Manetho, enable us now, without consulting Greeks or Romans, to decide that the Egyptian mythology was a device of Taautus, to give weight and effect to his ten books of laws, and the secular power. He treated useful discoverers, then dead, as gods; and he arranged some rude sacerdotal ceremonies.

Modern theorists, on these subjects, are even more absurd than the Greeks. Some, as Dupuis, see every thing in personifications of the zodiac and constellations; and our one-eyed Bryant refers every thing to Noah and his Ark! A Christian believes little that is asserted by a Mahometan, Hindoo, Chinese, or Jew; and, among Christians, Catholics do not credit Protestants, nor these Catholics. Prejudices are, in all things, greater than truth.

The gods and demi-gods, doubtless, were heads of society, as great inventors and benefactors. Thus, Vulcan, or Hephistus Diamichius, or Ammon, was the discoverer of iron, and the modes of forging it. Dagon (Osiris) invented the plough, and the making of bread. Taautus hieroglyphics, writing, the lyre, &c.; Menes, or Bacchus, introduced the vine, salt, &c. Chronus made the first sword and spear, assisted by his daughter Athena, or Minerva.

They were consecrated after death; their statues set up; and worship appointed. Taautus reduced the whole to a state religion, and engrafted rites and civil laws, in ten celebrated books. His hieroglyphics were symbolic, and resembled our system of heraldry, crests being changed as men behaved; and these changes were the silly transformations of the superstitious Greeks, who received the system through the half-informed colonists that settled on their coasts, from Phœnicia and Egypt, about 2000 B. C.

Whether the idiom of oriental language, or the custom of honouring ancestors and great men, was the cause of the title *Zeus*, or *God*, being applied to these men; or, whether it was a device of Taautus, to combine the sacred and legal authority, is uncertain.

Many Greeks, for many purposes, and many modern mystics, pretend that these ancient personages were mere poetical and theological personifications of passions and qualities. But, this is mistaking the effect for the cause, and oddly substituting their own theory for matter of fact.

Epiphanus says, that it was not till a *considerable interval* that Chronus, Rhea, Jupiter, and Apollo, were honoured as gods.

JUPITER was one of the seven sons of Cronus, by Rhea. Sanchoniatho mentions Adodus, as he who was called the chief of the gods; and Jupiter in Greece was at first called *the Dodonian*. Ouranus and Ge, whom the Romans call Uranus and Terra, protected him in Crete from Cronus, who had driven Ouranus from his continental dominions. In the family contentions with the children of Astarte, he headed the party of Ge and Rhea, his grandmother and mother; and the Titanides, the children of Astarte, being defeated, he became the head of his party, and the chief of this Theocratic Dynasty, in Greece and Asia Minor.

Cronus, on his abdication, divided his dominions thus:—to *Astarte* he gave Phœnicia, Syria, &c.; to *Belus*, Mesopotamia and Chaldea; to Adodus, or Jupiter, Crete, &c.; to Athenæ, Attica; to Mars, Thrace; to his brother Dagon, (Ahsf-Eretz, or Osiris,) Lower Egypt; to Poseidon, or Neptune, Barytus; and to Taautus, Upper or Southern Egypt.

This division, however, created such dissatisfaction, that Jupiter, Neptune, Mars, Dagon, and Athena, united against Astarte, Belus, and the Titans; and, hence that war, about which legends were converted, by the Greeks, into poetical extravaganzas. Cronus himself departed into Italy, and appears to have died in peace.

Probably, he there founded the kingdom of Rassena, or Etruria, and in his followers transferred the arts of Phœnicia and Egypt to that district, being afterwards worshipped as *Volturna;* but, according to some, he settled under Janus in Latium. Pindar sends him into the Atlantic, as far as the Hesperides, or Britain!

The TITANS, or Aletæ, were descendants of the hunters and sturdy husbandmen of early ages, often distinguished by colossal size.

Taken altogether, the Titan war, between the children of Cronus, by his different wives, was one of the most remarkable in ancient history; but the Greek poets make it appear more like a romance than matter of fact. It raged between 2830 and 2860 B. C. Its result settled the divisions of all these countries for many ages.

On one side was Cronus, aided by his son Jupiter, or Adodus of Crete; by Apollo, another son; by Neptune, or Poseidon, his nephew; and Mars, or Demarous, his half-brother; and Hercules, son of Demarous; with Osiris, or Dagon, King of Egypt, brother of Cronus; and by Taautus. On the other side was Astarte, and her family; with Pontus the Titan; Belus of Babylon; and all the Titans and Giants, commanded by Typhon, son of Cronus and Astarte. One was called the party of the *gods*, and the other of the *Titans*.

In spite of Greek disguises, there is no doubt that Typhon forced Olympus, the central position of the gods, and compelled them to flee to Egypt, where he pursued them, killed Osiris, and held the country 29 years. In time, however, the war was renewed, and it may be inferred that Typhon, who is blackened by the Greeks, like our Richard III., was ultimately killed in Sicily.

This family war arrested Belus in his grand design at Babylon, and it is very remarkable, that it was one of the charges made by the god party against the Titans, that, at Babylon, "*they were raising mountain on mountain, to scale Heaven!*"

The Planets derive their names from Cronus and his family, and court, before the Titan war, which divided the family. *Saturn* was so called after Cronus; *Jupiter* after his son Adodus, of Crete; *Mars* after Demarous, the foster-son of Dagon, and son of Ouranus; the *Moon* after Diana, Ceres, or Isis, the wife of Dagon, or Osiris; *Venus* after Astarte, the fair wife of Cronus, and mother of the Titanides; *Mercury* after Taautus, Thoth, or Hermes; the *Sun* after Apollo or Horus, the son of Osiris and Isis, or, in Chaldea, after Belus or Baal, the son of Cronus, born in Berea.

Then the names associated with the Planets and Stars, which were believed to be so efficient in fortune and misfortune, rendered them the gods of all ages and nations, in which faith in astrology prevailed.

Eupulemus says, that Atlas, the youngest son of Ouranus and Ge, was the inventor

of astrology; and Sanchoniatho says, that he was starved in a cavern, by Cronus and Hermes.

Corybantes were itinerant dancers, singers, and musicians; among whom, Jupiter was said to have been concealed and educated, just as a child might be put into the hands of our gypsies.

The Blacks are absorbed in superstitions, and these being inbred in the Ethiopians, were easily systematized by Taautus, and rendered national and imposing by vast structures, by establishments of priests, &c.: for the Bull, Ibis, Serpent, Lotus, &c. were mere varieties of the vulgar African Fetisches.

Waddington considers Ethiopia as the cradle of the religion and arts of Egypt. The temples are older, and the pyramids are more numerous, though smaller. Among the 330 kings of Egypt, Herodotus says, 18 were Ethiopians.

CRONUS, Ilus, or Saturn, preceded Menes, and was the first fixed monarch of Egypt, and surrounding countries. He had three wives, and several concubines, and was the father of most of the subsequent demi-gods.

OSIRIS was Dagon, son of Ouranus and Ge, and brother of Cronus. He invented the plough, and first cultivated bread-corn, for which he was called *Zeus-Arotrius*, or in Phœnician *Asti-Erotius*, Ahsi-Eretz, or *Osiris* in Egypt. He was killed by Typhon, his nephew, one of the sons of Cronus, after a reign of 35 years, and buried at Philœ. His hieroglyphic was a plough and other implements of agriculture.

HATHOR, or ATHYR, was Astarte, wife of Cronus, and called Venus, from her fair complexion. She had seven daughters, called *Titanides*, and two sons, called Pothos and Eros. The Greeks also called her Aphrodite.

RHEA, another wife of Cronus, by whom he had seven sons—Poseidon, or Neptune; Belus, founder of Babylon; Apollo; and Alodus the youngest, afterwards called Jupiter; and Muth, or Pluto, who died young.

Nephthe, the Greek Minerva, was (the same as Athena,) daughter of Cronus, to whom he gave Attica. She aided him in making iron weapons, and in the Titan war led an army into Egypt, and was there called Athena the Victorious.

NEITH, or Beruth, was the wife of Vulcan, or Elioun.

THOTH, or TAAUTUS, the thrice greatest, was son of Misor, son of Amynus. Mysor is believed to be Misraim, or the first Theban king; and Athothes, or Thoth, the second, Cronus giving him all Upper Egypt, while Osiris, or Dagon, reigned in the Lower.

Then, since Amynus, who first taught men to build villages, and tend flocks, was the father of Misor, or Misraim; we find in him the great Ammon, progenitor of the Pharoahs, and the AMMON RA of all the inscriptions.

AGROTES, who at Byblus or Babylon was called the greatest of the gods, and the protector of husbandmen and hunters, was the Pan of the Greeks, the Orion of the heavens, and Alorus, first King of Chaldea. His statue was drawn about Phœnicia, by yokes of oxen.

ARES, or ARTES, was the Demarous of Sanchoniatho, and the Mars of the Greeks. He was the son of Ouranus by a concubine, whom Dagon married, and was one of the Osiris, or Dagon party, against Typhon.

ESCULAPIUS Shum was the son of Sydyc the Just, by one of the Titanides.

PHTHAH was Chrysor, Hephæstus, or Vulcan, who discovered iron, and invented fishing-tackle and boats; and, also, one "who exercised himself in words, charms, and divinations." He was the first god-king, and his reign of 724 years by Manetho, and 680 by Castor, meant lunar periods, or 59 or 55 solar years.

PHRE was Hysistus, or Helius, son of Hephœstus, and called, in mythology, the Sun. He was the second god-king, and reigned 77 years.

CNEPH was Epigeus, AUTOCHTHON, or Ouranus, inventor of bricks, &c. He was the third god-king, and reigned 56 years, 6 months, and 10 days.

GE, wife of Ouranus, was the Greek Juno. She was the mother of Cronus and of Phatamen-Ousieri, or Dagon, and was the *Saté* of the Egyptians.

PROSERPINE, or Persephone, was a daughter of Cronus, and, dying young, she was said to be the *wife* of his *dead son* Muth, or Pluto.

Sanchoniatho mentions the death of PLUTO, or Myth, and his consecration by his father Cronus; and, being a *dead god*, he was called the God of the Dead.

NEPTUNE was Poseidon, to whom Cronus gave Berytus, inhabited by fishermen. He navigated the Mediterranean, and took part against the Titans. The Greek fables tell of his Lybian children, and of his son Albion, who, as was pretended, led a colony to Britain!

There was *no* Jupiter-Ammon. They were two distinct persons, Ammon and Jupiter, living at an interval of three generations. The father of Taautus, or Athothes, was Minor, Menes, or Misraim; and the father of Misor was AMYNUS, who is believed to be Ammon. Then Jupiter was the youngest son of Ilus, son of Epigeus, son of Elioun. But Ammon, whether Vulcan (Diamichius), or Amynus, was the Chief God of the Egyptians, and Jupiter, or Jevant, (the young prince) was of Crete, the Chief God of the Greeks. Their vanity led them to call their Jupiter, Jupiter-Ammon.

HERCULES was the son of Demarous or Mars, the son of Ouranus, by a concubine. He took part with Jupiter, another grandson of Ouranus, and with Dionysius contributed greatly to the defeat of the Titans. We then find that he led armies to the Straits of Gibraltar, and, after overrunning Spain, died in that country, when his army was dispersed. He was a hero, but the twelve labours, &c. &c. are silly inventions.

Megasthenes says, that Hercules and

Dionysius (Bacchus,) conquered India, and Sallust relates that Hercules perished in Spain, at the head of a mixed army of Medes, Persians, &c.

Sesostris, the Egyptian, overran Europe; and Tearcon, the Ethiopian, did the same, Nabucodrossorus, the Chaldean, as well as Tearcon, or Taracus, proceeded to the pillars of Hercules, and thence to Thrace and Pontus. Idanthurus, the Scythian, also overran Asia, even to Egypt, except India. Of some of these mighty conquerors we have no records. Tearcon was the Taracus of the 25th dynasty, who reigned 20 years, about 750 B. C.

Isis was either the daughter of Cronus or the concubine of Ouranus, whom Dagon married; and the Greek Ceres, her husband, being the inventor of corn, ploughs, &c. &c.

There is no doubt that Bacchus, about whom the Greeks propagated such a multitude of absurd legends, was Menes, or Dionysius, the first king of Egypt, who, according to Manetho, made extensive foreign conquests. The Greeks report his conquest of Ethiopia, and, probably, he passed thence by water into India, since he was of the Rhea Party, while Belus, on the Euphrates, was of the Titan Party. In Arabia he was Adenis; in Egypt Menes, or Dionysius.

Dr. Young thus gives their hieroglyphics:—Agathodæmon, Chnouphis, or Ammon, was the God of Male Nature, drawn as a man's head and a circle.

Neith, Minerva, Goddess of Female Nature, drawn as a Vulture.

Phtha was the brother of Ammon, a man with a hawk's head and head-dress, the Greek Vulcan, inventor of fire, and a great artist.

Phre, or Re, was Haleus, successor of Hephætus, a globe standing on the head of a hawk.

Saté, Juno, connected with Ammon.

Sme, or Themis, officiated in the Amenti.

Osiris was God of the Dead, with Muth or Pluto, a sceptre with the head of a wolf.

Gods have the head of a hawk in the hieroglyphics.

The Catholics ridicule the Egyptian God-kings, but forget their own Saints.

The Temple of matchless dimensions at Sais, to Neith, the Goddess of Female Nature, has on it the following sublime inscription, translated by Champollion, "I am all that has been—all that is—all that will be. No mortal has ever raised the veil which conceals me, and the fruit which I have produced is the Sun." The Hindoos apply to Vishnu a passage of like kind, "All which has been — all which is — and all which will be are in Vishnu. He illuminates every thing, as the Sun illuminates the world."

Sate, or Juno, is called, in the inscriptions, "the living goddess, daughter of the Sun. Queen of the Heavens and the Earth, the ruler of Lower Egypt, protectress of her Son, the Lord of the World, king of the three regions of Egypt, Son of the Sun, *Phatamen Ousieri*."

The most magnificent Temples were raised to Astarte, and that at Apollonius Magna is to her, and Harhat, or Cronus, and their son, Harsont-Tho, Horus, or the Eros of Sanchoniatho.

The Temple of Edfou was dedicated to Aroëris, Horus, or Apollo, son of Osiris, and one of the demi-gods.

Corn was first cultivated in Egypt by Isis, or the Ceres of the Greeks.

It merits emphatic notice, that the rival Chaldeans and Egyptians, and, perhaps, also, the Phœnicians, gave different names, or even assigned different persons to certain attributes of divinity. Then, as the Greeks understood neither Chaldaic, nor Coptic, nor Phœnician, so they confounded the three, and added to the confusion by Hellenizing the separate names.

All the transformations recorded in the Greek Poetry, or Mythology, were merely a change in the signet or recognized hieroglyphics, by which, before the invention of letters, men and women, especially those of note, were honourably or dishonourably designated. It resembled the crests of our heraldry. In many cases it might have been the judgment, or record, of a tribunal, or of the sovereign, and hence so many transformations were ascribed to them.

It is impossible to find terms strong enough to express the contempt due to the Greeks for their ignorant or wilful perversion of the Egyptian Theocracy. Perhaps, however, it has been, as it would be, if the future year 4000 received accounts of the English Religion from the Cherokees or Ashantees.

In reading Greek Authors, who speak of sons of the gods, about 1000 or 1200 B. C., we should remember that this was only in an astrological sense, a man being called a Son of Mars, or Jupiter, just as the planets Mars or Jupiter had most astrological dignities.

The Greeks, through Orpheus and other Poets, converted the Egyptian Helius into Phœbus; Ammon, or Agathodæmon, into Jupiter; their Cronus, or Phtha, into Saturn; their Osiris, or Muth, into Pluto; their Typhon into a Monster; their Neith into Minerva; their Saté into Juno; their Sme into Themis; their Isis into Proserpine; their Amenti into Hades; their Oms into Cerberus; their Thoth, or Taautus, into Mercury; and their Horus, Apis, and Anubis into Apollo, Minos, Æacus, and Rhadamantus.

The Chaldeans called Dionysius, or Bacchus, *Jao;* and he was often called Sabaoth or Demiurgus.

Bel, the Babylonish name of the Sun, or Belus, was pronounced *Baal* by the Hebrews; and Baal, Bel, or Pel, is the general name of great buildings and pyramidal temples through the East. The name Babel, or Babylon, meant the City of God. The Persians refer its foundation to Tamarath.

The chief difference between the Jewish historian and others lies in his referring the Giants, the Sons of God, and the mighty

men of renown, to remote ages preceding the Flood, while they refer the Gods, the Giants, Hercules, Bacchus, &c. to a period about 600 years after the Flood, or 2900 and 2800. They assert, too, that Xisuthrus, his wife, daughter, and pilot, were lost, and never returned; whereas, Noah lived long after, cultivated the vine, &c.

ANCIENT HISTORY.

No study is more interesting and specious than history, yet few events have been, or are, correctly or honestly recorded. Historians are either half-informed, or they are partizans; or they have been bribed to give false colours to crimes and follies.

The earliest records were monuments of stone; but, amidst legends, traditions, and revolutions, their use was transient. We still find them every where, but they serve only to mystify. The historic period does not, therefore, begin, till pictures, with hieroglyphic symbols and letters, in verse and prose, recorded events. Till these long stages of step-by-step discovery were passed, and till nations were organized, and public events became impressive, we have no materials. But even hieroglyphics, till our own age, had served only to render darkness darker. Written language itself ceases to be intelligible, in every fifty or hundred generations. The Zend no longer explains Babylonian history; the Hebrew is now unintelligible; the Phœnician, which spread the art of writing, has not preserved itself; the languages of Plato and Cicero are no longer spoken. Alfred would now be unintelligible, and the present penman will not be understood in 1000 or 1500 years!

Temporary notoriety is always in the inverse ratio of permanent celebrity. That which strikes the vulgar and ignorant, is not calculated to endure the cool examination of intelligence; and that which satisfies the intelligent few, is not understood by the multitude.

Two or three eternal names figure alone in the longest vista of human history.

Taautus, the Phœnician, perfected and fitted for use a system of written character, and raised medicine, geometry, and civil policy into sciences. Euclid, the Egyptian, perfected knowledge on figure, number, and quantity in the abstract, and laid a sure foundation for their application to motion, in the analysis of nature and phenomena.

The evidence of facts, in newly-discovered countries, shews that the bulk of the human species, through all past time, have made but slight advances, even in the common arts of living and comfort; while, in some countries, we still find them contending for mastery with wild animals. Science, high abstractions, knowledge of fire, of metals, of recording experience, of history, of arithmetic, of geometry, &c. &c. seem to be acquired by none of them; and time and experience have to them been useless.

If so many thousand years have passed without any improvement in the mere animal condition, we are forced to concede longer time than has been usually assigned to the periods which preceded weaving, ploughing, building, writing, metallurgy, geometry, astronomy, and astrology. What master-minds must have been engaged, and for how many ages, to produce Euclid's Elements, an Egyptian work, now 2000 years old, and yet absolutely perfect!

How wonderful, in like manner, this art of writing! Those alone, who have laboured at original ideas, can conceive the difficulties of *originality*, beset, as it was, at one time, by charges of magic, and, as it always is, by envy and persecution.

We dare not surmise the indefinite time which must have elapsed previously to the works of Euclid, Archimedes, and Aristotle, to the abstractions of Taautus and Plato; to the fabrication of the forge and plough; to the erection of a horoscope and astronomical observatories; and to the invention of cycles to record time!

In referring to the arts in question, we must also estimate them in comparison with New Hollanders, New Zealanders, &c., who have flourished as long without improvement, and not in reference to their accelerated state in certain countries; for arts add to arts, as rapidly as force adds to motion: and the year 2840 may, perhaps, regard 1840 as a dark age, in spite of conceits.

Nationality is inimical to the perfection of general history. Every people are absorbed by their own concerns. They see themselves in an angle of 89°, and all the rest of the world in the one remaining degree, and that discoloured and distorted in the horizon. A Phœnician only considered Phœnicia, a Greek only Greece; a Frenchman is wholly absorbed by France, and an Englishman by England.

War and other circumstances have destroyed so many records, that, although we begin with the Egyptians, Phœnicians, Hindoos, Chinese, Hebrews, Chaldeans, &c. we may imagine that many previous people would also have claimed attention if their records had not perished with themselves, and the very name of their nation. Bailly has traced the existence of a once-great unnamed nation near the Caspian.

Geology may explain what fables mystify, and writing and printing does not record. The Euxine burst into the Bosphorus and the countries of the Egean Sea; thereby draining the Aral, Caspian, and the channels of communication through Sarmatia to the Baltic. The Mediterranean overflowing, burst the pillars of Hercules, and thereby drained the central sea of Africa, as it opened at Syrtis. These changes forced the inhabitants to seek new countries, and robust emigrants, not being men of science, carried with them only the vulgar traditions, and hence all the fables of early history.

Homer called all barbarous, remote from Greece; and beyond Thrace was the hyperborean region of darkness; and, beyond

Ethiopia, the region of light, inhabited by Pigmies. The whole was surrounded, at the distance of 500 miles, by the River Ocean, by which the Argonauts returned from Colchis in the Black Sea. Eratosthenes and Strabo extended the land farther, but omitted China.

Orpheus, Herodotus, Pliny, &c., were equally incongruous, and referred every thing to the Mediterranean, as a centre. The priests taught that the Temple of Apollo, at Delphos, was the centre of the world. Beyond the Archipelago and the Levant, all was fable; and they believed that the whole earth might be viewed from any very high mountain!

Some philosophers, as Thales, Aristotle, &c., taught that the earth was a sphere; but the vulgar believed the priesthood, who placed their hell under ground, or beyond the adjacent sea.

The history of society has been the states of shepherd, cultivator, and dealer—heroism and usurpation—war and slavery—cities and local rights—contests, with usurpations mixed, and free constitutions, with returns to shepherd, cultivator, and dealer, or with intermediate disorganization and dispersion!

New lights have been opened on Ancient History, within this century, by increased investigations and discoveries in Egypt and Ethiopia; the countries which gave the first impulse to civilization in Western Asia and Eastern Europe. Previously, Ancient History had been viewed chiefly by reflection from the selfish policy of the Romans, and from the overweaning vanity of the Greeks; both of whom so mystified every thing, as to cloud events before their era, in an impenetrable mist of romantic poetry and mythology.

The hieroglyphic inscriptions, and the labours of Young, Champollion, and others, have, however, removed this veil, and given new importance to Sanchoniatho, Manetho, and Josephus; and we can now reason as correctly on events 1500 years before the era of Greek civilization, as on events but a few centuries before our own time.

From every circumstance, we collect that, in the early ages of Phœnician and Egyptian history, the then world and the human race were young, for the perihelion passed the equator from N. to S. about the year 5600 B. C.

Diogenes Laertius claims 48,863 lunations from Hephæstus to Alexander, *i. e.* 3972 solar years, or 4300 B. C., and Dicæarchus 2936 to the first Olympiad in 776, *i. e.* 3712 B. C.

Josephus says, that Pharaohs reigned in Memphis above 1300 years before Solomon, and long before Abraham, *i. e.* above 2315 years, while Memphis was recent.

Plato says, that the priests of Sais claimed 8000 years.

Pomponius Mela says, the Egyptians reckoned 330 kings, in 13,000 years.

Herodotus says, that they claim 330 kings in 17,000 years, from Heracles to Amasis, or Cambyses.

Diodorus Siculus says, there reigned from Vulcan to 56 B. C., when he visited Egypt, 470 kings and 5 queens, in not less than 33,000 lunations, or 2750 solar years.

The Old Egyptian Chronicle claims 36,525 years, no doubt lunar, or about 3000 solar years to Alexander. It then gives 300 years to the gods, and 217 to the demi-gods.

Eusebius makes it 3907 years from Menes, besides the previous gods and demi-gods.

Manetho claims, in his 31 dynasties to Alexander, 5471 solar years, and 307 for the gods and demi-gods.

The Greeks themselves admit that their travellers were often imposed upon. But, in such periods as 33,000, 17,000, &c. years, we may imagine there was a mixture of lunar and solar years. Again, there may be a difference of Epochs, and Astronomical cycles might have been introduced. But as we know, from Sanchoniatho, that the Babylonian Belus was a son of Cronus, and as several authorities concur in fixing the age of Menes about 2750, we may regard it as the nearest approximation that can be made, and this carries Vulcan to 3057 B. C.

Scaliger and Syncellus assign 1460 years to the Assyrian monarchy, before the first Olympiad, 776 B. C., and the Chaldean monarchy lasted 440 years, = 2676, a near approach to the age of Menes, in 2750, who was contemporary with Cronus.

Syncellus states, that under 86 kings, from Menes to Cambyses in 529 B. C., the kingdom of Egypt lasted 2211 years, *i. e.* from 2740 B. C.; then, adding 360 for the gods and demi-gods, we get 3100 for Hephæstus, or Vulcan.

Plato, who wrote 2200 years ago, states that the great Island of Atalantis, filled with cities, &c. was absorbed by the Ocean 9000 years before his time.

The Egyptians reckoned 14,000 years to the age of their original Vulcan, and 10,000 years between Menes and Sethon.

The Chinese, Japanese, Hindoos, and Chaldeans, claim indefinite antiquity.

Our Geology does the same, for thousands of years must have elapsed between each of the numerous formations which it discovers. At the same time, even the oldest historic period does not go back to any convulsions likely to generate such formations, and the successions of such exuviæ of animals and vegetables as are found, and so different from present species.

Moses says, that "*in the beginning* God created the Heavens and the Earth," but how many years elapsed since that undefined beginning, he furnishes no data to determine.

Delambre makes the diminution of the Obliquity of the Ecliptic 48″ in a century, and the Paris Observatory 23° 27′ 39″.3 on Jan. 1, 1834. It is evidently a decreasing quantity, since the Chinese observations made it 24°, 30 centuries ago. The difference is 1940″.7, which, at 48″, would be 4043 years, or 2209 B. C.

Essouan, or Syene, is recorded by Egyptians to have been, in their time, exactly

under the tropic; but it is found to be in latitude 24° 8′ 6″, and the tropic now is in 23° 27′ 38″, making a difference of 40′ 28″, which, at 48″ per Delambre in a century, gives 5550 years since the first observation. If, then, we take 1835 from this, we get B. C. 3715.

If the signs guide to the countries of their invention, the precession indicates the period. No country would adopt water and fishes as signs but the Egyptians, and they began to count their year at our Michaelmas, the turn of the flood of the Nile. Aquarius was, therefore, the first appropriate sign; and we find it currently so on the breastplates of Mummies, in their 28 mansions of the moon. But the stars of Aquarius are now advanced to February. The Dolphin Cluster to Jan. 25; Deneb Algadi to Feb. 9; and Markab to Feb. 28; which, *sans phrase*, requires 8550 years for 119°; 9000 years for 136°; and 10,000 years for 154°.

The Editor, on a physical theory (the progression of the perihelion) makes the Deluge 5766 years ago, a very close approximation to the Septuagint, Samaritan, and Josephus of 5739 years; and the present Jewish year 6000. The perihelion has moved 99° since it passed the equator, and it moves 360° in 20,937 years, that is, 1° in 58·14 years.

The next northern Deluge, on this theory, will be in 81 times 58·14 years, or 4709 years; that is, in anno domini 6542, or 50 or 100 years earlier.

Every people have traditions of a Deluge, and every district, rock, and stratum, affords evidence of many. Geology is but their natural history, and their chronological cycles are the revolutions of the line of Apsides; by which each hemisphere and the waters are subject, alternately, every 10,468 years to the Perihelion and Aphelion action. 1840 taken from 5771, gives 3926 for the period when the plains of the northern hemisphere began to drain.

The Mexicans had a tradition of a deluge, in which *Coxcox* was saved, and a serpent-woman. They had pyramids and traditions of four regenerations, like the Hindoos, hieroglyphic writings, &c.; all indicative of former connection.

Pliny mentions traditions of the irruptions of the Atlantic into the basin of the Mediterranean.

The Hindoo philosophy teaches, that nature proceeds, in course, till the actions and re-actions counterpoise; that disorder then follows in the contest of powers; and, finally, a balancing course arises, contrary to the first course.

Champollion, from the inscriptions, and a most accurate analysis, determines the reign of Menes to begin in 2782 B. C., and Rosellini, of Pisa, his colleague, fixes it in 2712. Both accord, therefore, with three versions of the Jewish History, and with Josephus, and really the only variance is in Jerome's Vulgate.

If the Hieroglyphics give no dates, for want of fixed Epochs, they give the exact succession of sovereigns, so as to verify Manetho. The Tablet of Abydos gives a long train in Manetho's exact order, and four other inscriptions give us short lists in the same order. In fact, Rosselini, in his magnificent work, (so creditable to Pisa,) gives us fine portraits of Manetho's 18th and 19th Dynasty, with their exact hieroglyphics, copied from Temples and Tombs. The variety of his subjects render us, in fact, better acquainted with ancient Egypt than we are with any modern nation.

The Abydos Tablet fixes the reign of Sesostris in 1473, but this must have been the middle of his reign, if the Parian Chronicle, which fixed the arrival of Danaus, in Argos, in 1511, *is to be relied on*. He reigned 68 years, and began his reign in 1520, so that Danaus left Egypt in his 9th year. Now Josephus says, that from the Shepherd Kings to the departure of Danaus was 393 years, which, added to 1511, gives 1804 B. C. for the departure out of Egypt. Then Josephus says, that Sesostris reigned 59 years after the departure of Danaus, and this brings his death to 1452 B. C. Again, in summing up the reigns, in Manetho, from 1511 to the 25th year of Tuthmosis, we find, by comparison, exactly 393.

Manetho, Josephus, the Parian Chronicle, and the Hieroglyphics concur; therefore, in carrying the Exodus of the Jews to 1804, the 511 for the sojournment per Josephus, and 290 from Jacob to Abraham, gives 2606 for the birth of Abraham, hitherto taken at 1996 by the Vulgate; but, 2605 accords with the Samaritan and the Septuagint versions.

This Epoch is confirmed by references to Greek History, as the Epoch of Inachus, the flight of Danaus, the Flood of Deucalion, the Siege of Troy, and the first Olympiad recorded in the Parian Chronicle, &c. We find, too, that Sechonsis, or Shisac, who overthrew Rehoboam, began to reign in 934, and that the monuments of that Pharoah, still existing, record the circumstance. Again, we have the age of Nechao, who captured Joachaz, to be 607, or 327 years after the former. In fact, the hieroglyphics of above 50 sovereigns, still existing on Banks's tablet, and other monuments, agree exactly with the successions of Manetho.

Josephus had such superior advantages in compiling his works, that it is wilfully putting ourselves in the wrong to reject his chronology, and that of Manetho, which he adopted; and prefer to them Jerome's Vulgate, for no better reason than that it was adopted by *the Romish Church* in a very dark period.

The Egyptians reckoned by the year of 365 days, and hence lost a day every four years, and a revolution in 1424 years. Whenever the Zodiac was invented, *Aquarius* began the year, and this was either in 2027, or 3451, or 4875, &c. The fixed modern year begins August 29, the time of the falling of the Floods, which, no doubt, was the first degree of Aquarius, when the Zodiac was invented.

It harmonizes too, with Hephæstus, or Vulcan, in 3100, with the commencement of the Hindoo Cycles in 3185 and 3101, the Greek Church Deluge 3686, and the passage of the Perihelion into southern declination, about 3250.

The recession of the first of ♒ into the stars of Sagittary, is the measure of the precession since the adjustment by Hipparchus, 160 B. C.

The Hindoos begin the creation as a mere astronomical epoch, when all the planets were in Aries, or nearly 2000 millions of years since; and then, taking in the motion of the nodes and apsides, they extend it to 4320 millions, which they call a *Calpa*, or day of Brahma.

Lucian traces the progress of the sciences from India, through Ethiopia, to Egypt and Chaldea.

The rock temples of Elephanta and Salcette, near Bombay, and of Ellora, near Aurungabad, are gigantic works, dedicated to Siva, and presumed to be more ancient than the Egyptian ruins, which they resemble.

Of Bactria we know little. Bailly traced a distinguished lost people in that region. It was nautical when the Caspian, Aral, Euxine, and Baltic, were united. It was the due east of Judea, Greece, and Egypt, and the country of Zoroaster. Learned Hindoos still refer to it, as the common parent of astrology, astronomy, geometry, arithmetic, magic, &c., spread around into China, India, Persia, &c. Caucasus, the Altaic chain, and the Steppes raise it above the general level of Asia.

The Bactrian region was the country of Promotheus, of Gog and Magog, of Noah's ark, of men on horseback, (the centaurs of the Greeks,) and of Cyclops, the first builders in stone; while the western nations, the British, Irish, &c., trace their origin to tribes emigrating from that region.

For want of a better, or of any rational theory on the subject, it may be suggested, that the *Incarnations of Vishnu* are historical, and that they mean simply the successive states of *Nature* on our globe. Each state is considered as the preserving God, in a visible or personified form, relatively to the condition of nature, at the period of each incarnation. The vulgar idea of Vishnu's *tangible* forms has resulted from ignorance, or misrepresentation; an incarnation being mistaken for a literal description, instead of its being the mere allegory of a fact.

Iran, or Eeran, was the country of Zoroaster, and means the land of Believers. He was one of the Bactrian philosophers, whose doctrines spread over Asia.

Jemsheed, according to Bailly, invented the cycle of 1440 years, in 3209 B. C.

The Chinese claim an extreme antiquity. Fo-hee, their first emperor, reigned about the year 2950 B. C.; and from that time their histories give a regular succession of emperors and events. Yao, who flourished about the year 2357, is celebrated for his virtues and wisdom. From Fo-hee to Shun was 500 years; from Yu to Kie was 387 years; from Tching-tang to Sheeo-sin was 612 years; from Voo-Vang to Nang-Vang was 808 years; from Nang-Vang to Cong-tee was 105 years. Crozier's History of China, in 15 quarto volumes, translated from the history published under imperial authority begins with *Fo-hee*, 2953 B. C., and proceed through a regular succession to our days.

Contemporary with Fo-hee were the god-kings of Egypt, and the western empire of Ouranus and Cronus, extending over Asia Minor, Syria, Egypt, &c.

The Greeks knew nothing of the Chinese, and the Romans little. In 530, the first silk-worms were brought from China to Italy. Confucius, their moral teacher, flourished about 550 B. C.

They refer the discovery of silk to Seeling-shee, the queen of Hoangtee. Iron, they say, was discovered by Fo-hee from burning wood on brown earth. Chinese history is that of ordinary life, in the very ages which the Greeks and others fill the world with prodigies, fables, and miracles.

The First Western Empire.

The Phœnicians appear to be the most ancient of the western people, and in their Sanchoniatho and the Jewish Moses, we have the earliest records of history, all in relation to that vicinity.

Sanchoniatho must have written long before Moses, since he speaks almost as a contemporary of the god-kings, the Giants, and the discoverer of iron; whereas, Moses's account of the intercourse of *the Sons of God* with the fair daughters of men, is spoken of as in days of old, "and there were giants and mighty men of renown in those days," (*Genesis*, vi.) referring to an extreme antiquity.

Moses speaks of Tubal Cain, Jabal, and Jubal, in a way which exactly accords with some of the gods and demi-gods, but refers all to remote ages, before the destroying Flood of Noah. If the circumstances took place between 3000 and 3500 B. C., and Moses wrote about 1750, then it may be assumed that Sanchoniatho wrote about 2500.

Eusebius introduced the fragments of Sanchoniatho into his Evangelical Preparation, book 1, chap. 9 and 10, copying from a translation of *Philo of Byblos* who seems to have mingled opinions of his own with the statements of Sanchoniatho, while Eusebius copied only as much as served his purpose.

Philo of Byblos, who translated Sanchoniatho, was distinguished as a grammarian and historian, and lived from the reign of Tiberius to that of Adrian.

Manetho flourished in the reign of Ptolemy Philadelphus, about 260 B. C. He was keeper of the Sacred Archives in the temple of Heliopolis. He wrote a General History of Egypt, now lost, and drew his facts from the Sacred Columns of Trismegistus. He has also had attributed to him a poem, which is praised, and a work on the Rites and Ceremonies of the Egyptians.

Porphyry refers Sanchoniatho to the age

of Semiramis, who flourished about the year 2000, according to general chronology; but, according to Manetho and Sanchoniatho, much earlier. Others suppose that he was contemporary with Gideon, since he refers to Jerombaal, priest of the god Jeue. But Sanchoniatho himself says, that the Chaldeans worshipped Bacchus as Jeue. He dedicates to Abidus, King of Tyre, or Byblos, imagined to be the father of Hiram.

Julius Africanus copied the history of Manetho into his Chronographia, but, of this work, only some scraps are preserved by George the Syncellus, in the 8th century, who gave the 31 dynasties from Menes to Darius. Scaliger and D'Origny have since published them with notes. Josephus often quoted Manetho in his reply to Appian, and praises his fidelity and exactness. Julius Africanus was born in Judea, and lived at Emmaus, and he afterwards lived in Alexandria, and wrote his Chronographia.

G. Syncellus, of Constantinople, is valuable in copying Julius Africanus, and other lost authors. He makes the epoch of Adam 5500 B. C., and the Deluge 2242 after, or in 3258 B. C. He gives an Arab Dynasty from 3001, and refers the kingdom of Sicyone to 3238, and Argos to Inachus in 3691, and Athens to Cecrops in 3945. The Siege of Troy he fixes in 1172. He has preserved more than any other writer of the middle ages. He quotes apochryphal writers, but has preserved others. He died in 800.

Sanchoniatho says, "the wind, Colpias, and his wife Baau, or Night, begat Æon and Protogonus, and that Æon discovered food on trees. Their descendants were Genus and Genea, who dwelt in Phœnicia, and worshipped the Sun as Beelsamin, Lord of Heaven. Genus begat Phos, Pur, and Phlox, who discovered fire by the friction of wood, and begat giants of vast bulk. Among the descendants were Hypsuranius, who constructed huts, and Usous, his brother, (with whom he was in enmity) who invented clothing with skins, and constructed a raft of trees to go to sea. He also consecrated two pillars to fire and wind, and sacrificed to them; practices kept up by their survivors.

Long after were born, of the race of Hypsuranius, Agreus and Alieus, inventors of hunting and fishing. From these descended two brothers, who discovered iron and forging; and one of them, Chrysor, or Hephæstus, used charms and divinations, and invented boats and sails, for which he was worshipped, under the name of *Diamichius*. His brother invented bricks.

From the same race descended Technites and Autochthon, who improved bricks and tiles; and, after them, Agrus and Agroues, the last of whom was worshipped. They invented porticoes, first used dogs in hunting, and were called Aletæ or Titans.

Subsequently Aminus and Magus taught men to construct villages, and tend flocks; and Misor and Sydyc found out the use of salt.

From Misor descended Taaut, who invented letters, and the same, says Eusebius, whom the Egyptians call Thoor, or Thoyth, and the Greeks Hermes; and the Thracians, &c., *Thor*.

From Sydyc descended the Dioscuri, or Cabiri, or Corybantes, or Samothracians, who first built a ship.

He then relates that Elioun and Beruth, near Byblus, begat Epigeus, or Autochthon, called Ouranus, Heaven; and his sister Ge, Earth. That Elioun was killed by wild beasts, and Ouranus marrying Ge, they had four sons, Ilus, or Cronus, Betylus, Dagon, (inventor of bread, corn, and the plough,) and Atlas. Ouranus had other wives, and Ge was so jealous of them, that he sought to kill his children.

Cronus, his eldest son, having Hermes Trismigestus for his secretary, opposed Ouranus, defended his mother, and, by Hermes' invention of a scymetar and spear of iron, drove Ouranus from his kingdom. In the contest, he took a pregnant concubine of Ouranus, married her to Dagon, and her son was Demarous. Cronus also, on suspicion, killed his own son Sadidus, and one of his daughters, and destroyed his brother Atlas.

Ouranus sent his three daughters to destroy Cronus, but he married them, and baffled other attempts of Ouranus; who also devised *Bætulia*, stones that moved as having life.

Sydyc the Just begat Asclepius, by one of the Titanides.

Ouranous and Demarous made war on Pontus, son of Nereus, but were defeated. From Pontus descended Sidon, inventress of odes.

In the 32d year of his reign, Cronus took his father Ouranus prisoner, and dismembered him, so that be died.

When danger from war and pestilence threatened Cronus, he sacrificed his son by Anobret at the altar; and such was the custom of the rulers of cities and nations, to appease the deities.

In another line of descent there was Elioun, or Hypsestus, and Beruth. Then Epigeus, Autochton, or Ouranus, and Ge. Ilus, or Cronus, Betylus, Dagon, or Siton, or Zeus Arotrius, Atlas, Demarous or Zeus, Athena, and Sadidus.

Enemerus, who lived about 300 B. C., confirms, in a rude outline, this history of Sanchoniatho. He says, *Ouranus* was the first king, and had 2 sons, Pan and Cronus; and 2 daughters, Rhea and Demetra. *Cronus* succeeded him, and married Rhea, and had by her Jupiter, Hera, and Neptune. *Jupiter* succeeded and married Hera, Dematra, and Themis; his children, by Hera, were the Curetes; by Rhea, Persiphone; and, by Demetra, Athena. He visited Belus at Babylon, went to the Indian Island, Panchœa, returned by Syria, and conquered Cilicia. If this be true, and Alorus is Pan, then we trace two sovereignties, that of Chaldea and Western Asia, which seems probable.

*** *We are indebted, literally, to* Mr. Cony's 'Ancient Geography' *for many of these paragraphs, a Work which ought to be studied by every lover of real Antiquity.*

Sanchoniatho, abridged as he is by Eusebius, makes Ancient History plain, as far back as the year 3000 or 3100 B. C. We have brought before us the foundations of Greek and Asiatic History. The first extended western sovereignty was commenced by Hephæstus, known as Vulcan to the Greeks, and as Elioun, Diamichus, or Amynus, to the Phœnicians and Egyptians. He lived about 3100 years B. C., or 36,000 lunations from the age of Herodotus.

The period was about 330 solar years:

Hephæstus	55
Helius, his son	86
Ouranus	57
Chronus, Ilus, or Saturn	40
Dagon, or Osiris	35
Typhon	29
Orus	28

Contemporary with whom were the personages called demi-gods, Apollo, Jupiter, Mars, or Ares, Ammon, Hercules, Anubis, Tithoes, and Sosus.

Meander, of Ephesus, wrote a History of Tyre, quoted by Josephus.

Circumcision was an ancient practice of the Egyptians, Ethiopians, Phœnicians, Syrians, &c., and other Asiatic people, as a precaution against diseases. Cronus had himself circumcised, and he made his allies do the same.

The ruin of Phœnicia, by the Assyrian and Persian Despots, paved the way for the maritime ascendancy of the Greeks. Miletus and Phocœa began then to colonize.

The Tyrians excelled as dyers in purple, 2000 years B. C.

The analogy between the Hebrew and Phœnician is proved by the following:—

HEBREW.—Na eth elionim velioneth sicorath jismacon Zoth.

PHŒNICIAN.—Ny thalonim valon uth si corathisima Consith.

The Jews and Phœnicians called all countries. in the Indian Ocean, Ophir; and the Phœnicians had factories in the Persian Gulf, in aid of their eastern trade. Tyre, too, sent regular caravans all over Asia, and Heeren has traced their routes.

The pillars of Hercules were either Mount Abyla in Africa, and Mount Calpe, or real pillars erected on them, afterwards Phœnician sailing-marks.

The Phœnician Hercules is said to have conquered Lybia and Spain, and erected columns at the entrance of the ocean. Carnac, in Brittany, was probably his work, as well as Abury, &c.

The Phœnicians laid the basis of western commerce, invented letters, navigation, glass, &c., and colonized the coasts of the Mediterranean, the Atlantic, Ireland, South Britain, &c. They considered themselves the most ancient of mankind. They founded Utica, Carthage, Septis, Gades, Malaga, Adrumentum, Tysdrus, and colonized Sardinia, Sicily, Malta, Spain, and Tartessus. Gades is believed to have been built before the 12th century.

Heeren believes, that from Gades the Phœnicians traded along the coasts even to the Baltic. The government of Carthage sent out Himilco to make discoveries, in 500 B. C.

The Phœnician territory was 120 miles from Tyre to Aradus. Sidon was the first city noticed in Jewish History, though Sanchoniatho called Byblus the first. The adjacent provinces were *Galilæa*, *Gaulonitis*, and *Galaaitis;* and we have, therefore, no difficulty in tracing the origin of the names *Gael*, *Gaul*, *Gades*, &c.

Phœnicia was at the pinnacle of power between the years 2000 and 750 B. C., and, in fact, its people were the instructors and civilizers of the whole western world.

Canaan extended from lat. 31° 15′ to 33° 5′, or 130 miles *long;* and, from lon. 35° to 36° east, or 45 miles *wide*. The whole was 6000 square miles. The entire kingdom of the Jews lasted 120 years: of Israel, separately, 216 years longer; and of Judah 370 years. Both were then merged in the Babylonian empire.

Jewish History.

The Jews were descended from Abraham, a Culdean, of Ur, or Orfa; but their enemies, Diodorus Siculus, Tacitus, Celsus, the Emperor Julian, &c., describe them as Cretans, who settled in Idumea, so called from Mount Ida, in Crete, and hence the name Judea.

They also record, that a contagious leprosy breaking out in Egypt, Amenophis and Rameses drove all the diseased into the deserts of Idumea, where their chief was Moses, a former priest of Osiris, and under his instructions they finally settled themselves in Judea. Their exclusive ordinations and tenacity, in maintaining them, drew on them the special hatred of the various ambitious conquerors of the East; and the Romans, in particular, exterminated them.

Abraham must have lived after Taautus, the inventor of the idolatry of Western Asia; since, we know, that Terah, Abraham's father, was a maker of idols in Ur, of Culdea, and that his brother Lot had a collection as household gods. Abraham is described, by Greek writers, as a man skilled in magic and astrology, the learning of his times. Nicolaus Damascenus says, that Abraham was King of Damascus, and came with an army from Ur, but afterwards removed into Canaan.

The Eloeim were a sacred hierarchy, according to Moses; but Sanchoniatho relates, that they were the allies of Ilus, and so called after his name.

The Jews themselves confer on Ezra parallel importance to Moses. To him they ascribe the collection and arrangement of their Bible; and hence it is, that Jewish tribes in the East, and in Central Africa, dispersed before Ezra, have no books but

the law, and that the Samaritans never recognised the historical books.

Ezra appeared to be unable to restore the oft-quoted books of Jasher, the Annals of the Kings, and the Book of the Wars of the Lord; he also seems to have lost most of Solomon's 3000 Proverbs and 1005 Songs; and, what is to be regretted, Solomon's Natural History. His version was in Chaldaic.

On the return from the Babylonish captivity, the Chaldaic continued the vernacular tongue of the Jews, and the law, read in Hebrew, was expounded to the people in Chaldaic.

Ezra made 54 sections of the five books. The present chapters and verses were of the 13th or 14th century.

The original language of the Jewish Scriptures being obsolete, we rely on early translations into Greek and Latin. The modern versions are from Jerome's translation, called the Vulgate. Then there is the Septuagint, a Greek Translation, made for Ptolemy Philadelphus, when he was forming the Alexandrian Library, about 300 B. C.; and the Samaritan copies. The whole being verified by the compiled history of Flavius Josephus, made for the purpose of correcting Roman errors about the persecuted Jews.

As the Jews had no epochs and no chronology as a science, the guesses of commentators lead to many discrepancies. The Septuagint, no mean authority, supported in a great degree by Josephus and the Samaritan version, assigns:—

From the Deluge to Abraham	1257
From Abraham to Jacob............	290
Sojourn in Egypt, per Exodus	430
Departure to Solomon	873
Solomon to Christ	1156
In all, years	4006

Instead of the 2348 of Jerome's Vulgate.

Taken thus, the Jewish history embraces all the demands of astronomical records, and the combined pretensions of general ancient history, while 1840 added to 4006, gives 5850 years since the Deluge. The modern Jews date the current year as 3600.

The birth of Abraham is usually fixed at 1996, but without any precise data. Josephus himself, a learned Jew, with all the resources of ancient MSS., and with every motive for accuracy, is our only chronological authority. He proves the whole, by giving 393 years before the epoch of Danaus, as the period of the Exodus.

The high authority of Dr. Thomas Young, (the ablest philosopher which this country can boast,) carries the era of Thuthmosis to 1840 B. C., in the middle of whose reign the Jews were expelled from Egypt; for which, we have the authority of Josephus and Manetho. Then Josephus fixes 511 years for the sojournment in Egypt, and there being an agreed 290 years from Abraham to Jacob, we have 1815 + 511 + 290 = 2616 for the birth of Abraham.

Bishop Cumberland makes the epoch of Thuthmosis 1825 B. C.; and then, for the sake of the Vulgate, argues against the deduction on Greek evidence, other than the Parian Chronicle.

Ptolomæus, Appian, Josephus, &c., say, that the Exodus took place in the time of Inachos, who built Argos, about 1807 B. C.; and this agrees with Manetho, Young, &c., as to the precise age of Thuthmosis, the Pharoah who expelled the Jews.

Diodorus says, that the King of Egypt expelled all foreigners, owing to a contagious disease with which they were affected. And that Moses conducted a colony of them into Judea. Lysimachus states, that many of the incurable were drowned, and others conducted into the deserts by Moses. Polemo calls them deserters from the army, in the reign of Apis, son of Phoroneus.

We have a discordance between Josephus and Exodus. He asserts, emphatically, that the Jews were 511 years in Egypt, but Exodus calls it 430.

Timaus was *Pharoah*, when Jacob went into Egypt; and Thuthmosis drove them out in the 25th year of his reign, and he reigned 25 years and 4 months afterwards. Then, if this was in 1815, Josephus's 511 carries us to 2326 for Jacob's emigration; and 290 to Abraham, again fixes his birth in 2616, or 620 years before the commentators on the Vulgate.

The Jews, while in Egypt, had their own dynasty of governors in their own provinces for 161 years, by name Salatis Beon, Apachas, and Apophis, according to Josephus, to whom Manetho adds Staan and Archles. They became so numerous and intolerant, and so afflicted with leprosy, that the Theban sovereigns, and others, united and expelled them into the desert. They were headed by a priest of Osiris, called Osarsiph, whose name was changed to Moyses Tisithin; and he was assisted by a sacred scribe, whose name was Josephus Peteseph. Palmanothis had been the Jewish persecutor. He compelled them to build Kessa, and its temple, and the temple of Heliopolis, and to work in the quarries. His daughter, Merris, wife of Chenephres, having no children, brought up a child of the Jews and named him Moyses Artapanus. So say *Manetho*, *Josephus*, *&c.*

Manetho says, that the priest who ordained the polity and laws of the expelled "sacrilegious shepherds," was by birth of Heliopolis, and his name *Osarsiph*, from Osiris, the God of Heliopolis; but when he went over to these people, he was called *Moyses*. Chæremon says, the leaders were two scribes called *Moyses Tisithen*, and *Josephus Petiseph*. Manetho then adds, that after the departure of the nation of the Shepherds to Jerusalem, Thuthmosis, the King of Egypt, who drove them out, reigned 25 years and 4 months.

Both Niebuhr and Burckhardt think that the Jews passed the Red Sea near Suez, where Niebuhr forded it himself. The 603,550 fighting-men, a fourth of all males and as many females, made up a vast caravan of nearly 5 millions.

Egyptian History.

The Arabians call Egypt emphatically *Misr*, the place—the Jews *Misraim*. It was anciently called Mestrea, or Misraim, from Mestraim, or Menes, the first king.

Diodorus says, Ethiopia was never conquered, and that Bacchus failed against them. They call the Egyptians a colony led from Ethiopia, and say that Egypt is but the mud of Ethiopia. They state, too, that the sacerdotal hieroglyphics of the Egyptians were used by all the Ethiopians.

Menes, and his son Athothis, believed to be Taautus, were the first localized Kings of Egypt; and, according to Manetho's corrected lists, he began his reign about 2800 B. C.

Champollion found a tomb which refers to the last king of the 17th dynasty, and he who expelled the Jews; and another contains five sovereigns of the 18th dynasty.

Herodotus and others state that Sesostris was the builder of the chief temples of Egypt. He also constructed canals, and the pictures on the great temples are records of his achievements.

The antiquity of Cities was, in order, Meröe, Syene, Thebes, Memphis, Bubastes, Byblos or Babylon, Damascus, Sidon, &c., all built before the year 2500 B. C.

The recent travels of Calliaud, Ehrenberg, &c. &c. to Meröe, in 17 N. lat. and in Southern Ethiopia to 10°, afford proofs of high and early civilization in those countries. Duplicates of temples, pyramids, colossal statues, &c. are found 3 or 400 miles south of the Cataracts, and they confirm the traditions that this country was civilized before Egypt. The true Ibis, the Golden Beetle, and the Hunchback Ox, are all found indigenous there.

Herodotus refers the three great pyramids to Cheops and his two successors, Cephranes and Mycenius; but Manetho refers the first to Sophis, of the 4th dynasty.

In 1821, Belzoni exhibited in London the tomb of Nechao, king of Egypt, of its natural size, with all its figures and hieroglyphics. The figures represented a procession, including captive Ethiopians, Jews, and Persians. This is explained in Chron. xxxv. 2. and in Herodotus, who calls Jerusalem, Cadytis, a large city of Syria.

In 1819, Belzoni visited El Wah, the Oasis, containing the temple of (Jupiter) Ammon. It is in ruins, but he was not allowed to approach it.

In 1817, Captain Caviglia, with great enthusiasm, removed the sand from around the great Sphinx. and beneath found, in front, an inclosed temple, and altar, with inscriptions in hieroglyphics and Greek. The paws are stretched fifty feet in advance of the body, and one inscription speaks of "that fierce Sphinx that Thebes, ere while, laid waste."

The most wonderful assemblage of Egyptian antiquities is now at Thebes. They cover a vast extent in four distinct villages, two on each side of the Nile. Luxor and Carnac on the eastern, and Gournou and Medinet Abbou on the western. All is colossal, in red granite, shaped and carved, overwhelming all beholders with astonishment; but it is time mocking men, for the names of the despots who thus employed the people are forgotten.

Two sitting figures, near Thebes, are 60 feet high, of one block of reddish sandstone, on pedestals 18 by 14, and 6 high. One of them, by its hieroglyphics, represents Amenophis II., who reigned in 1651 B. C. In the Ramesseion is a broken statue, 63 feet round the shoulders, 13 feet from the crown of the head to the shoulders, 13½ from the shoulders to the elbow, and 7 feet over the foot, so that it must have been 80 feet high. The court in which it stood has columns whose capitals are 32 feet round, and the fronts of the columns are figures, 20 feet high to the shoulders. An inscription, in hieroglyphics, ascribes the whole to Rameses, beloved of Ammon-Ra, king of the gods. Now, Rameses was fourth of the 19th dynasty, and not Sesostris, because he recorded the achievements of Sesostris.

Bread, barley, and wheat, are often found in Egyptian tombs.

Pharoah is Coptic for king.

The zodiac of Dendera, or Tentyra, is projected on the plane of the ecliptic, and is merely *the horoscope* of the time of completion, or the nativity of the reigning sovereign. The pole is midway between the signs, and in or near the Great Bear, which as to Capricorn is on the Cancer side, and lying even between the middle of Gemini and Sagittarius. It is now even between ten of Virgo and ten of Pisces; consequently, the constellations have advanced about fifteen in Gemini, sixty in Cancer and Leo, and ten in Virgo, since it was constructed, *i. e.* $85° \times 72$ years $= 6020$ years. The planets, &c. &c. are marked on it, and the outer circle is the *usual* astrological speculum.

Night begins where the two semi-discs are marked on the serpent; the semi-disc standing for N. or S. latitude, and this equal point was then in Gemini. Hence, it has fallen back nearly three signs, and the two circumstances agree.

In the horoscope, Scorpio is ascending, Taurus descending, and the *Part of Fortune is in Cancer*. The hour is nine in the evening, about April 20. The ☉ was in the beginning of ♉, the ☽ in ♐, ☿ in ♈, ♀ in ♓, ♂ has N. lat. in ♉, ♃ in ♒, ♄ in ♏; the Dragon's head is in ♐, the tail in ♊, and all the chief fixed stars are located in each constellation.

It is now at Paris, and is a square of 7 feet and 9 inches.

Champollion's theory of hieroglyphics tends to prove that they are representations of ideas, and not of sounds. They are of two kinds, *hieratic*, or sacerdotal, and demotic, vulgar, or enchorial. On this view, Akerblad, Young, and Champollion, have

imagined a sort of alphabet, by which they decypher names and some ideographic sense. The names, Ptolemy, Cleopatra, and Alexander, afford the keys of comparison.

Memphis, now to be traced only by its mounds of rubbish, is spoken of by Edrissa, in 1200, as built 4000 years before, or in 2800. There was a statue 45 feet high, of one block of red granite.

Ancient writers indifferently used lunar years or solar years, for the sake of even numbers, at a time when the relations of the two were not fixed, leaving it to the common-sense of readers to discriminate.

Egypt declined with the rise of Greece, and, in fact, never recovered the atrocious invasion of Cambyses, in 525 B. C. The Hermaic language was lost in the destruction of the Priesthood by the Persians, the Ptolemies, &c.

Sauchoniatho, Manetho, Josephus, and the Hieroglyphics, confer connection on Egyptian History; and Moses, Ezra, and Josephus, on Jewish, while the Chinese have been systematic Chroniclers; but, owing to wars and conquests, we have slight records of Hindoo History, and very imperfect accounts of the Empires in Central Asia.

Asiatic History.

The Assyrian Empire began with Alorus, or Orion, whose dynasty of 10 kings ended with Xisuthrus, in a deluge from which he escaped in an ark to Caucasus, but did not return to Sippora, his companions reporting that he, his wife, daughter, and the pilot, were caught up by the gods. This dynasty was followed by Evechius, or Nimrod, in seven kings, and these by six Arabians. Cronus then gave Babylon to Belus and Dione, both of whom were afterwards deified as Bel and Baaltis, or Diana. This dynasty lasted till Sardanapalus, who was burnt in his Palace about 67 years before the first Olympiad, or in 843.

The ten Kings of Chaldea, who preceded Xisuthrus, or the Deluge, correspond in number with Moses's ten Patriarchs. They were Alorus, or Orion, Alaparus, Amelon, Ammenon, Megalarus, Daonus, Euedoracus, Amemsinus, Oliartes, or Ardates, and his son Xisuthrus, who reigned 120 sari, or 2220 years, but there is no likeness in the names to Adam, Cain, Seth, &c. Yet there is some resemblance to names in Sanchoniatho, who, it may be suspected, referred to renowned personages in Western Asia, which seemed to be one patriarchal sovereignty.

The next dynasty of the Chaldean Kings began with Evechius, Nebrod, and Nimrod, and lasted 225 years.

The third Chaldean dynasty began with Nabonasor, and in 20 kings ended in 219 years. The 17th was Nabuchodonosor, who reigned 43 years, and conquered all Western Asia and Egypt, finished Babylon, built its triple walls, its palace, hanging-gardens, &c.

No fact is more certain, on the evidence of various ancient authors, than that the first Chaldean dynasty of ten sovereigns was terminated by a deluge, from which the last king, Xisuthrus, escaped from Sippora, in Syria, in an ark to the Northern Mountains of Caucasus, against the stream of the rivers. The sacred historian calls him Noah, but does not speak of him as a king. The Septuagint version fixes it in 4000 B. C., and this harmonizes with other events; but the Catholic commentators on the Vulgate (without the shadow of reason,) fix it in 2348, which was impossible, if it was general; for Chinese, Hindoo, and Egyptian History, begin between 3600 and 2348.

If rain had caused the deluge, the current of the rivers would have carried the Ark to the Sea; it seems, therefore, that the current came from the sea over the land, so as to carry the Ark from the sea to the mountains.

There is concurrent authority to shew that Cronus was contemporary with Belus, and both with the Titan War. But Manetho's three books give 5471 years, and the Assyrian monarchy of Belus is clearly not so ancient. We may hence conclude, that Manetho gives contemporaries in Upper and Lower Egypt. He gives the kings of each, and also of other divisions of Egypt, just as though an historian gave the separate contemporary kings of England, Scotland, and Wales. It is, however, not easy to separate them. His Memphite Kings make up about 1800 years, and the Diospolite 1163, which together seem to make up the whole period. The Thinite, Elephantine, Tanite, Bubasite, &c. were contemporary.

In three succeeding reigns of the Chaldean Kings came Oannes, or Annedotuses, out of the sea, part fish, part man, who taught all wisdom. It seems possible that the marine visitors were voyagers, such as our Cook or Wallis at Otaheite or Owyhee. Perhaps they came from America, and might belong to the lost people, whose remains are found over the American Continent. Nothing in ancient authors is more circumstantial than the accounts of them by Berossus, Apollodorus, and Abydenus. Humboldt seems to identify them in his account of the engraved gems found in Cumana, so like those described by Landseer.

Their names were Oannes, Eudocus, Eneugamus, Eneubolus, Anementus, and Anodaphus.

The Assyrian kings at Babylon began with Belus, the son of Cronus, who reigned 55 years, and who, with Typhon, headed the Titans and the Astarte branches against Jupiter, and the Rhea branches in the great Titan War. He married Baaltis, or Dione, since famed as Diana. From them, in the fifth generation, was descended the second recorded king, Ninus, who built Nineveh, and reigned 52 years. He was succeeded by Semiramis, so famed for conquests, who reigned 42 years. They were succeeded by at least 36 others, down to Thonus or Sardanapalus, in 843 B. C. That kingdom lasted in the succession of 41 names 1460 years, besides names not inserted.

Thus, the two previous dynasties of 13 Chaldean kings (after the first of 10,) endured

225 and 215, *i. e.* 440, which carries Evechius or Nimrod to 2743. But every ancient author states that, from Nimrod to Sardanapalus, there were 86 kings, or 32 more than enumerated, which, at 20 per reign, would carry us back nearly to the Septuagint era of the Deluge, 3426, and reign of Xisuthrus.

If, then, we deduct 100 years unsettled after the death of Xisuthrus, and the 440 for the two dynasties, we get 2886 for the commencement of the great Assyrian Empire, under Belus, son of Cronus.

Eupolemus says, that Babylon owes its foundation to the Giants, who were saved from the previous Deluge. Damascenus remarks, that at the Deluge many persons retreated to the great mountain Baris in Armenia, and were saved, and that one, in particular, was carried thither northward, in an ark.

Castor relates, that Belus took part in the Titan war, and that the Giants who aided the Titans were slain by Hercules and Dionysius, themselves Titans.

Thallus says that Belus, with the Titans, made war against Zeus Jupiter and his compeers, called Gods; and that Gygus fled to Tartessus.

Syncellus says, the building of the observatory at Babylon was arrested by the war of Cronus, and the Titans under Belus, against Jupiter and the Rhea family.

It is asserted, that Belus built the great tower as a security against future inundations of the sea, as an observatory, and as a temple.

Ninus and Semiramis were warlike sovereigns of Assyria, who, by large standing armies of nearly two millions of fighting-men, overran Asia to the Indus. In their time Nineveh was built and adorned, as a rival to Babylon. Besides their vast armies, they had 10,600 armed chariots and fleets of fighting ships, while other kings brought nearly equal forces into the field, and terrible slaughters covered that populous garden of the world.

The empire was overthrown by a conspiracy of three viceroys, who divided it into the three kingdoms of Assyria, Babylon, and Media.

The Assyrian kingdom, 150 years after, was conquered by the others, and Nineveh destroyed.

Cyrus, the founder of the Persian empire, lost his life in a battle with a Scythian tribe, in 529 B. C.; but Xenophon says, he died in peace.

The Babylonians worshipped fire, as the emblem of the Sun. They were acquainted with geometry and mechanics, and were perfect manufacturers, their products selling at vast prices in all countries. Their astronomy was accurate, but subservient to astrology. They lived like the Hindoos, chiefly on vegetables, in which the country, owing to inundations, was productive.

Babylon was the centre of the caravan routes in ancient times, and the seat of exchanges, East and West.

Cylindrical signets, engraved in intaglio on jasper, chalcedony, jade, and onyx-stone, about one or two inches long, and half an inch in diameter, were used as seals in Ethiopia, Chaldea, Arabia, and other nations of Western Asia. They are found in the ruins of Babylon, Nineveh, &c. and are mystical and curious. Landseer has displayed profound erudition in illustrating them.

Our translation states, that Abraham was called out of *Ur* of the Chaldees; but the original is, that "he went out of the *fire* of the Casdims to go towards Canaan." This is explained by the Jews, as referring to his being condemned, by Nimrod, to fire, for breaking his father's idols, and to his brother Haran being burnt. It is stated in 28th ver. chap. xi. in literal translation, that Haran died in the fire of the Casdims.—*Blackwell.*

Hellah is the nearest town to the present ruins of Babylon, and Mosul is on the site of Nineveh.

The Persian kings, from Cyrus, in 556, to Darius III., were 10, and reigned 207 years.

The Medes had eight kings from Arbaces to Astyges Darius. Deioces V. founded Ecbatana.

Pasadarga was the ancient capital of Persia, built by Cyrus, whose tomb still exists there.

Susa is now Shus, with ruins, 11 miles. Ecbatana is now Hamadan.

Balkh and Canoge are the oldest cities in the East.

The tombs of the Persian kings were caves in rocks, inaccessible except by an apparatus of ropes from above.

Persepolis is in the plain of Merdasht, across which runs the Bend-emir, or Araces, and near Shiraz. It is called the throne of Jemsheed, the second king, or the palace of forty pillars, and is said to be that of Darius, burnt by Alexander when drunk. It resembles, in magnitude and gigantic sculpture, the Egyptian temples; but the execution is far more perfect, and the figures and objects more interesting and numerous. It is about 80 miles north of the Persian Gulf, and 220 east of Babylon.—*Porter.*

The native Persian historians begin their history with King Kaiomurs, the first created man, according to the Guebres. He was such a personage as Osiris, Bacchus, or Rama. But one historian carries back their history to Mahabah and his wife, who escaped the last great flood. The history of his successors, of Jemsheed, the grandson of Kaiomurs, Khoesrou, Afrasaisib, Isfundear, Roostum, and Darab, or Darius, are then filled with wonders like the Arabian Nights.

These native Persian writers take no notice whatever of the ancient Persian empire, described by the Greeks and Jews; on the contrary, Persia is by them limited to the Euphrates, and all the glories and power of the country, if they ever existed, are buried by its own historians in unaccountable oblivion! We learn from Malcolm, who had the best sources, that one Zo-

hauk, a foreigner, dethroned Jemsheed, but was slain by Kowah, a blacksmith, who restored Farihoon; and, hence, a leathern apron became the Persian standard. But no Greek author names this standard; and it is very extraordinary that the Persians say not one word of *Xerxes*, or of any king named by the Greeks or Jews. All they say of this period is, "that Gushtasp, (Hystaspes,) protected Zoroaster; and that a king of *Rome*, named Secunder, (Alexander,) subdued a king of Persia, named Darab!"

One of their dynasties is called *the Judges*, a curious similarity to Jewish history. Jemsheed is said to have reigned 700 years, and Zohauk 1000 years, which, of course, must mean their dynasties. From Alexander to Artaxerxes Babigan, who, in 226 expelled the Parthians, *i. e.* 500 years, native Persian history is a void.

The doubts about the genuineness of the Zendavesta of the Parsees appear to be removed. Heeren believes the part called Vendidat to be earlier than Cyrus; and Heeren considers the first section as descriptive of Asia, by Zoroaster, in the age of mammoths and elephants, when the tropics were some degrees wider.

Most ancient people, especially the Asiatic nations, were divided into castes, or fixed hereditary employments.

Cicero relates, that the Chaldeans and Bactrians claimed celestial observations for 470,000 years; but, taking a day as an astronomical period, it becomes 1300 solar years, or a moon, or 32,000 years; so there is, palpably, some ignorance in the reporters, or some mistake of the figures by ignorant transcribers. Perhaps it was a mere astronomical cycle.

⁂ For Epochs and Events down to our own age, see the article Time and Chronology.

The Lombards, or Longobards, overrun Italy in the 6th century, and maintained a kingdom till Charlemagne. Under his successors it was divided into states and free cities, the Pope being the chief. Genoa, Venice, Milan, Florence, Naples, &c. rose to great power, but the country was alternately conquered by the Germans or French. The chief states now are Sardinia and Naples, and the Austrians are the ruling power.

The Sclavonic tribes, which now form Russia, were first organized by Ruric, a Swede, about 820. Its chiefs were called Grand-dukes till 1100, when the title of Czar was taken. In 1223 they became tributary to the Mongul Tartars, but, in 1477, they were expelled; and the sovereigns, till Peter the Great, generally died violent deaths. Since his time there have been four empresses and four emperors, and the Russian power threatens Europe on every side.

Gustavus Vasa made Sweden independent of Denmark, in 1523.

Denmark, Sweden, and Norway, constituted the ancient Scandinavia.

Spain was a province of Carthage and Rome. It was then overrun by the Vandals, Suivi Alans, and Visigoths. In 711 it was invaded by the Saracens, and held for the Caliphs at Bagdad, who made Cordova the capital. In 1150, the Christians established the kingdoms of Castile, Leon, Arragon, and Navarre. About 1250, the Moors only held Granada. In 1479, the Christian provinces were united under Ferdinand and Isabella; and, in 1490, Spain was free from the Moors, Joan, their only child, marrying the Emperor of Germany their son, Charles V., became Emperor and King of Spain. The five Philips, and other kings, were imbeciles; and Spain, in 1800, had sunk to a second-rate power, and, since then, has lost its vast American colonies. A contest about the succession, during which cruelties were practised by both parties, which disgraced the name of civilization, was happily terminated in September, 1839.

Of Arabic history little is known before the Christian era. Marib was the capital of the Sabean kingdom of Himayar, where star-worship and astrology flourished for above 2000 years. Marib was, however, destroyed, in the third century, by the bursting of a reservoir constructed to regulate the streams from the high lands. Mahomet, in 622, united them in faith, and the spirit of proselytism; and, in 642, they overthrew Persia; by 675 they had penetrated Barbary to the Atlantic; and, after overrunning the Spanish Peninsula, they were checked at Poictiers in 732; while, in 717, they overrun Asia Minor and besieged Constantinople. Before 800, they had introduced their faith through the centre of Africa, along its Eastern coast, and in the Oriental Islands.

Mahmud, the Mahomedan Sultan of Ghizna, about the year 1000 invaded India 12 times, and laid the foundation of the Mogul empire. In 1192, his descendants defeated three powerful allied rajahs, and established a government at Delhi. Altmish, in 1230, extended his dominions; but, in 1288, several murders made Ala-ad-din king. At length, Firoz reigned 37 years as a benefactor, and dying, in 1388, Timur-leng ravaged the whole country, and every province had its own rajah or king. Baber, a Tartar, in 1526, restored a general sovereignty; and, in 1556, Akber became the first general sovereign, and lived to 1605.

He was followed by Jehangir, Jehan, and Aurungzeb, who reigned in splendour 49 years. His four grandsons then disputed for ascendancy, during which Nadir Shah invaded India, committing atrocities without parallel. Shah Alem then became mogul at Delhi; but, being captured by the Rohillas, they blinded him, and, in 1803, he was taken in Delhi by the English, who, at his death, appointed Akber Shah a nominal mogul!

The Persian empire began under Cyrus, in 559 B. C., and ended in Darius, 333. There were thirteen sovereigns previously with Kaiumers. And three after Darius, from 252; Arsaces to Yesdejird 632. Then 57 Mahomedan Khaliffs to Mastarem 1242

The first king of Judah was Saul, in 1095; the last Zedekiah, in 597. Of the ten tribes separately, Jeroboam, in 975, and the last Samariah, 721. The Syrian kings were Hyrcanus, 136, and the last Agrippa, 37 A.D.

Authentic and verified Chinese history runs back 6000 years; others mixed with fable to 30,000 years.

The Chinese claim 22 dynasties of emperors, two of them Hia and Chang, before the age of Samuel, or 1122 B. C., and 3 others with 64 emperors before our era. The other 17 dynasties have had 126 emperors down to the Manchu, in 1644, of which there have been 6 down to Ka-Hing.

Carthage was occupied by Dido, 869 B. C.; Cyrene by Bathus, in 630 B. C.

Iwan, an infant, succeeded legitimately to the Russian empire, in 1740; but Elizabeth, daughter of Peter I., usurped the crown in 1741, and imprisoned, during her life, Iwan and his father, mother, and family. Iwan was kept in a dark room, and finally murdered by his guards; his mother died in prison in 1746; and his father in 1776, after 35 years' imprisonment. His children were liberated in 1779, and sent to their aunt, the queen of Denmark.

A monarchy was formed in Russia, about 1000, under Rurie and Vladimer; but, from 12 to 1500, it was overrun by the Tartars. They were expelled by Iwan, and the Republic of Novogorod united. Some cossacks, under Yermak and Kopilos, then overran Siberia, and united the whole. In the reign of our Elizabeth, it was so little known, that in a voyage to Archangel, Moscovy was treated as a discovery. Peter and his successors, since 1710, have raised it into a power dangerous to all liberty, if not to civilization.

In 5 centuries, France had 326 years of war for 174 of peace; and in the wars were fought 184 bloody battles.

Clovis the Frank, aged 20, defeated the Romans at Soissons, in 492, and founded the French monarchy, under the laws of the conquered. His four sons divided the monarchy.

The first 400 years of Roman History were fabulous; and Buonarotti thought Rome, as well as Tarentum and Naples, were built by the Phœnicians or Greeks.—*Spence.*

The admitted History of China began in 1122, B. C. The age of Eli with the dynasty of Shu. There were 2 previous, Hea and Chang, and 19 others since, making 22. That of Shu had 35 emperors, Tsin 16, Thang 20, and Sing 18.

The earliest historical Hindu dynasty was that of Anala Chouham, whose reign began in Ajmer, A. D. 500. The first Rajas of Udaypur began in 728. The Mahommedan kings of Ghizni began in 977, by Sabaktezin; and Mahmud the Third began his reign in 997, reigning 33 years. The first of Delhi was Ibek, in 1193, and there were 6 dynasties down to Akber, in 1806. The Mahratta kingdom began in 1651, and there have been 14 sovereigns.

The last modern event is the overthrow of the Turks, near Aleppo, and the hereditary accession of Mehemet Ali, Viceroy of Egypt, as Sultan of Egypt and Syria.

Notes and Abstracts.

There were 12 kings of Macedon from Philip 360 B. C. to Perseus 179.

There were 22 kings of Syria from Seleucus 312, to Antiochus IX., in 69 B. C.

There were 7 kings at Rome from 753 to 534, then a republic for 461 years. The emperors from Augustus to Romulus Augustus in 475, were 55, with 7 or 8 double sovereigns.

The kingdom of Naples began in 1284 by Charles. From 1506 to 1755, it was Spanish.

The first Czar of Russia was Fedor in 1585, and there have been 18.

The Vandals, after over-running France, Spain, and Italy, conquered North Africa; but, a century after, they were conquered by Belisarius for the Eastern Empire.

There were 13 Mongul emperors from Jangez or Ghengis, in 1205, to Timur-leng, or Tamerlane, in 1384. This dynasty ended in Uluph Beg, in 1446, but there were 9 other sovereigns, and among them Abbas the Great, from 1582 to 1627.

The first king of Prussia was Frederic, in 1701, and there have since been Frederic II. (the Great,) and 3 Frederic Williams.

There were 15 Ptolemys, in Egypt, from 323, to Cleopatra III. in 51 B. C., when it became a province of Rome.

There were 22 kings of Judah, from Saul 1095, to 597; 18 in Samaria from 975 to 721.

The Kingdom of Sweden commenced in 1019, by Amund; and of Denmark, in 1014, by Canute the Great; and it was united to Norway in 1438, and separated in 1815.

There were 25 Scotch kings from Malcolm in 1004, to James VI. in 1567. Duncan from 1034 to 1040. Macbeth from 1040 to 1056.

Arnulf was the first Emperor of Germany in 888, and there have been 48. Rodolph, of Hapsburgh, was the first of the reigning dynasty in 1273.

The first Bishop of Rome was Lewis, in 67 A. D., and there were 62 down to Gregory in 590. The first Pope was Sabiances, in 604, and there have been 177 down to 1829; the average reigns being but 7 years! There have been 21 Johns, 13 Innocents, 13 Clements, 14 Benedicts, 12 Leos, 15 Gregorys, and 11 Bonifaces.

The Portuguese monarchy commenced under Alfonzo, in 1139. The kings of all Spain under Charles, in 1516; of Arragon by Ramieres, in 1035; and Castile by Ferdinand, in 1034.

France has had 5 dynasties from Clovis, 481 A. D. to Childeric III. 742. The Carlovingian from Pepin 751, to Lewis V. 986. The Capetian from Hugh Capet 987, to Charles IV. 1321. The Valois from Philip VI. 1328, to Henry III. 1574. The Bourbon, of 9 sovereigns, from 1589 to this time.

Ching-Vang built the Great Wall, 250 B. C.

The Greek empire lasted till the taking of Constantinople, and with little distinction except in Justinian and the Comneni. Most of the emperors fell by assassins or in the field.

COMPARATIVE CHRONOLOGY OF BRITISH, FRENCH, AND GERMAN MONARCHS.

YEAR.	ENGLAND.	FRANCE.	GERMANY.
800	Egbert.	Charlemagne.	Charlemagne.
814	.. ..	Louis I.	Louis I.
836	Ethelwulph.	.. ..	.. ..
843	.. ..	Charles the Bald.	Louis II.
857	Ethelbald.	.. ..	.. ..
860	Ethelbert.	.. ..	.. ..
866	Ethelred I.	.. ..	.. ..
872	Alfred the Great.	.. ..	.. ..
876	.. ..	.. ..	Carloman.
—	.. ..	.. ..	Louis III., the Younger
—	.. ..	.. ..	Charles the Fat.
877	.. ..	Louis II., the Stammerer	.. ..
879	.. ..	Louis III.	.. ..
—	.. ..	Carloman.	.. ..
884	.. ..	Charles the Fat.	.. ..
887	.. ..	.. ..	Arnold.
888	.. ..	Hugh.	.. ..
898	.. ..	Charles the Simple.	.. ..
899	.. ..	.. ..	Louis IV., the Infant.
901	Edward the Elder.	.. ..	.. ..
911	.. ..	.. ..	Conrad I.
919	.. ..	.. ..	Henry I.
922	.. ..	Robert.	.. ..
923	.. ..	Ralph.	.. ..
925	Athelstan.	.. ..	.. ..
936	.. ..	Louis IV.	Otho the Great.
941	Edmund.	.. ..	.. ..
946	Edred.	.. ..	.. ..
954	.. ..	Lotharius.	.. ..
955	Edwy.	.. ..	.. ..
959	Edgar.	.. ..	.. ..
973	.. ..	.. ..	Otho II.
975	Edward the Martyr.	.. ..	.. ..
978	Ethelred II.	.. ..	.. ..
983	.. ..	.. ..	Otho III.
986	.. ..	Louis V.	.. ..
987	.. ..	Hugh Capet.	.. ..
997	.. ..	Robert the Pious.	.. ..
1002	.. ..	.. ..	Henry II.
1016	Edmund Ironside.	.. ..	.. ..
1017	Canute.	.. ..	.. ..
1024	.. ..	.. ..	Conrad the Salic.
1031	.. ..	Henry I.	.. ..
1036	Harold Hare-foot.	.. ..	.. ..
1039	Hardicanute.	.. ..	Henry III.
1041	Edward the Confessor.	.. ..	.. ..
1056	.. ..	.. ..	Henry IV.
1060	.. ..	Philip I.	.. ..
1065	Harold II.	.. ..	.. ..
1066	William I.	.. ..	.. ..
1087	William II.	.. ..	.. ..
1100	Henry I.	.. ..	.. ..
1106	.. ..	.. ..	Henry V.
1108	.. ..	Louis VI., the Gross.	.. ..
1125	.. ..	.. ..	Lotharius II., the Sax.
1135	Stephen.	.. ..	.. ..
1137	.. ..	Louis VII.	.. ..
1138	.. ..	.. ..	Conrad III.
1152	.. ..	.. ..	Frederic I., Barbarossa.
1154	Henry II.	.. ..	.. ..
1180	.. ..	Philip II., Augustus.	.. ..
1189	Richard I., Cœur-de-Lion.	.. ..	.. ..
1190	.. ..	.. ..	Henry VI.

YEAR.	ENGLAND.	FRANCE.	GERMANY.
1198	.. ..	.. ..	Philip & Otho IV.
1199	John.	.. ..	.. ..
1212	.. ..	.. ..	Frederic II.
1216	Henry III.	.. ..	.. ..
1223	.. ..	Louis VIII.	.. ..
1226	.. ..	Louis IX. St. Louis.	.. ..
1250	.. ..	.. ..	Conrad IV.
1254	.. ..	.. ..	William of Holland.
1257	.. ..	.. ..	Richard, D. of Cornwall.
1270	.. ..	Philip III., the Bold.	.. ..
1272	Edward I.	.. ..	.. ..
1273	.. ..	.. ..	Rodolph of Hapsburgh.
1285	.. ..	Philip IV., the fair.	.. ..
1292	.. ..	.. ..	Adolphus of Nassau.
1298	.. .	.. ..	Albert of Austria.
1307	Edward II.	.. ..	.. ..
1308	.. ..	.. ..	Henry VII.
1314	.. ..	Louis X., K of Navarre.	Louis of Bavaria & Fred. [of Austria.
1316	.. ..	Phil. the Tall, King of [Navarre.	.. ..
1322	.. ..	Charles IV., the Fair, K. [of Navarre.	.. ..
1327	Edward III.		.. ..
1328	.. ..	Phil. IV, the Fortunate.	.. ..
1346	.. ..	.. ..	Charles IV.
1350	.. ..	John I., the Good.	.. ..
1364	.. ..	Charles V., the Wise.	.. ..
1377	Richard II.	.. ..	.. ..
1378	.. ..	.. ..	Winceslaus.
1380	.. ..	Charles VI.	.. ..
1399	Henry IV.	.. ..	.. ..
1400	.. ..	.. ..	Robert.
1411	.. ..	.. ..	Sigismund.
1413	Henry V.	.. ..	.. ..
1422	Henry VI.	Charles VII., the Victor.	.. ..
1437	.. ..	.. ..	Albert II.
1440	.. ..	.. ..	Frederic III.
1461	Edward IV.	Louis XI., the Prudent.	.. ..
1483	Edward V. Rich. III.	Chas. VIII., the Affable.	.. ..
1485	Henry VII.	.. ..	.. ..
1493	.. ..	.. ..	Maximilian I.
1498	.. ..	Louis XII.	.. ..
1509	Henry VIII.	.. ..	.. ..
1515	.. ..	Francis I.	.. ..
1519	.. ..	.. ..	Charles V.
1547	Edward VI.	Henry II.	.. ..
1553	Mary.	.. ..	.. ..
1558	Elizabeth.	.. ..	Ferdinand I.
1559	.. ..	Francis II.	.. ..
1560	.. ..	Charles IX.	.. ..
1564	.. ..	.. ..	Maximilian II.
1574	.. ..	Henry III.	.. ..
1576	.. ..	.. ..	Rodolph II.
1589	.. ..	Henry IV, the Great.	.. ..
1603	James I.	.. ..	.. ..
1610	.. ..	Louis XIII.	.. ..
1612	.. ..	.. ..	Matthias.
1619	.. ..	.. ..	Ferdinand II.
1625	Charles I.	.. ..	.. ..
1637	.. ..	.. ..	Ferdinand III.
1643	.. ..	Louis XIV, the Great.	.. ..
1653	Cromwell.	.. ..	.. ..
1658	.. ..	.. ..	Leopold I.
1660	Charles II.	.. ..	.. ..
1685	James II.	.. ..	.. ..
1699	William and Mary.	.. ..	.. ..
1702	Anne.	.. ..	.. ..

YEARS.	ENGLAND.	FRANCE.	GERMANY.
1705	.. ..	.. ..	Joseph I.
1711	.. ..	.. ..	Charles VI.
1714	George I.	.. ..	.. ..
1715	.. ..	Louis XV.	.. ..
1727	George II.	.. ..	.. ..
1742	.. ..	.. ..	Charles VII.
1745	.. ..	.. ..	Francis I. Mar. Theresa
1760	George III.	.. ..	.. ..
1765	.. ..	.. ..	Joseph II.
1774	.. ..	Louis XVI.	.. ..
1790	.. ..	.. ..	Leopold II.
1792	.. ..	Republic.	Francis II.
1804	.. ..	Napoleon, Emperor.	.. ..
1806	.. ..	.. ..	Confed. of the Rhine.
1814	.. ..	Louis XVIII.	.. ..
1815	.. ..	.. ..	Germanic Confederacy.
1820	George IV.	.. ..	.. ..
1824	.. ..	Charles X.	.. ..
1830	William IV.	Louis Philippe.	Ferdinand I.
1837	Victoria.	.. ..	.. ..

BIOGRAPHY.

[*In the following Article it has been attempted to record, in brief, only the* ORIGINAL MINDS *who founded or originated. Biography, in general, is filled with mere imitators, or with men noted only for chance of birth, or necessary position in society. Even with this limitation, the Article is far from complete; but it will afford data in the absence of larger Works. The main object has been to multiply interesting facts and* FUNDAMENTAL DATES.]

AARON, high-priest of the Jews under his brother Moses, and, previously to the expulsion of the Jews by Thuthmosis, about 1850 B. C., was known in Egypt as a scribe, by the name of Josephus Petephen. His two sons were destroyed for using other than sacred fire. His rod blossomed, in proof that his tribe of Levi was chosen for the priesthood. Nevertheless, in the absence of Moses, he set up the Phœnician golden calf as an object of popular worship. He died at Mount Hor, aged 123.

There were two Shahs ABBAS, Kings of Persia; the first reigned from 1585 to 1630, and the second in the reign of Charles II.

ABDERAMA, a great Moorish general, killed in 732, in the bloody battle with Charles Martel, between the Cher and Loire, where it was said the Moors lost 375,000 men, and Martel but 1500, owing to an ally of Abderama deserting him in the midst of the battle.

ABDUL WAHAB, a Mahomedan reformer, or Puritan, was born about 1696, and, in 1800, the sect had overrun all South-east Arabia, including Mecca and Medina; but, about 1820, they were defeated, and most barbarously repelled by Mahomed Ali.

ABELARD, was a learned professor, who debauched Heloise, and, being at the point of marrying her, her uncle caused him to be castrated, on which he became a monk and she a nun. He wrote many works, died in 1142, and was buried by Heloise in her nunnery at Paraclete.

ABUBEKER, the father-in-law and successor of Mahomet as *first Caliph*. He accepted, as Caliph, but three pieces of gold as an annual salary, the maintenance of a single camel, and a black slave. Five pieces of gold and a coarse garment were all he left to his family.

ABULFEDA, Prince of Hamah, one of the few sovereigns who have filled a throne with wisdom, and distinguished himself by devotion to learning and science. He wrote a Geography, Universal History, &c. &c. still in existence, and, as productions of the thirteenth century, by one who had access to all Arabic sources, worthy of translation into English. His MSS. are at Paris.

ACHILLES, the most heroic of the Grecian generals engaged in the siege of Troy, where his history is mingled with all the absurd superstitions of Homer's times. He was killed, in 1184 B.C., by the wound of an arrow in his heel, by Paris, the brother of Hector, whom he had killed, and whose body he had dragged at his chariot-wheels.

There were two ADAMS, American Patriots; JOHN, born in 1731, and who died in 1826, on the 50th Anniversary of Independence; and SAMUEL, in 1722, who died in 1803. The nephew of John, named JOHN QUINCEY, was the fourth President.

ADANSON, a naturalist, died in 1796.

ADDISON, author of the Spectator, &c. died in 1719.

ADELUNG, the very learned German philologist, died in 1806.

Pope ADRIAN IV. was Nicholas Breakspear, a native of Abbots Langley, and of

very poor parentage. He converted the Norwegians, was made Cardinal, and elected Pope in 1154, as which, for four years and eight months, he tyrannized over the contemporary kings as much as any of his predecessors or successors.

ÆSOP, the Euclid of moral science, was born of parents who were slaves in Phrygia, and was sold as one at Samos to a liberal master, one Xanthus, under whom he displayed his wit and talents, and, finally, obtained his freedom. He was afterwards patronized by Crœsus, the rich king of Lybia, and then by the kings of Babylon and Egypt, in which period he composed his Fables. At Delphos he ridiculed the ignorant priests and magistrates, and was, in consequence, thrown from a rock, about 500 B.C.

ÆSCHYLUS, a tragic writer, died about 330 B.C.

AGAMEMNON, King of Argos, was the commander of the Greeks in the siege of Troy, but he was murdered on his return by his wife and her favorite.

AGIS, a King of Lacedemon, was formally put to death by the legislature, for governing contrary to the laws.

Cornelius AGRIPPA, was a learned physician, and, therefore, in the semi-barbarous sixteenth century, a reputed magician. He was a friend of Trithemius, Erasmus, and Melancthon, and held various state-offices at Metz, &c. He died in 1534.

AGRIPPINA, a woman infamous in Roman History, was the daughter of Germanicus. She was sister of Caligula, wife of Claudius, and mother of Nero, and three times married. She was put to death by Nero's order, A. D. 60.

One of the greatest wonders of female genius was Signora AGUESI, born at Milan in 1718. At nine she was familiar with Latin; at eleven she spoke Greek with fluency, and at fourteen was acquainted with several oriental languages. At fifteen she was an expert mathematician, and she published on conic sections, finite quantities, and infinitesimals. In 1750, she was appointed Professor of Mathematics and Natural Philosophy at Bologna, and, after becoming a blue nun, she died in 1799.

AIKIN, Dr., a tasteful writer, died 1815.

AKBAH, the Saracen conqueror of the Northern coast of Africa, about 700. Another Akbah was the Great Mogul from 1556 to 1605.

AKENSIDE, poet, flourished 1750.

ALARIC, King of the Visigoths, who, between 376 and 410, overran Europe, and took and sacked Rome.

ALBERTUS MAGNUS, master of the palace to Pope Alexander IV., and Bishop of Ratisbon; he had, in the 13th century, the fame of being a great magician, owing to his studious life and various knowledge. He died in 1280, aged 87.

ALCIBIADES, flourished 420 B. C.

ALCUIN, flourished 800 A. C.

There were three ALEXANDERS, Kings of Egypt, two of Epirus, three of the Jews, three of Macedon, (he who was called the Great being the third,) two of Syria, and three of Scotland, besides minor potentates, and seven popes of this name.

ALEXANDER, the son of Philip of Macedon, who, owing to the extravagance of his ambition, has been called the Great, at the age of twenty, in 336 B. C., became the leader of the armies prepared for the purpose by Philip. First destroying the liberties of Greece, he made an irruption into the too extended Persian empire, easily defeated the Asiatic myriads of Darius at the Granicus and Issus, and pursued Darius to death. After destroying the illustrious Phœnicians and Tyrians with atrocities never surpassed, he visited the Oasis of Ammon, passing to Babylon, and thence to India, wasting life on every side for the lust of conquest. Intoxicated by success, he fancied himself a god, and died either of poison or drunkenness, at Babylon, in 323, in the 33d year of his age; having disturbed the world, he left it in a disorder which led to a century of crimes and bloody revolutions. His generals seized his conquests, and destroyed his mother and children; while the only benefit was the establishment of the first Ptolomies in Egypt.

ALEXANDER, a popular Emperor of Russia, succeeded his murdered father, Paul, in 1801; and, after various wars and encroachments on neighbouring states, died in 1825, aged 48.

Pope ALEXANDER VI. had four sons and a daughter, and he desired to re-establish the Roman empire in his son Cæsar Borgia. Wishing to poison some Cardinals at a feast, a bottle of poisoned wine was confided to an attendant; but, by mistake, he gave some to the Pope, who died in consequence, in 1503.

ALFIERI, the famous Italian dramatist, was born in 1749, and, after writing about 50 tragedies and poems, he died in 1803.

ALFRED, fourth son of Ethelwolf, succeeded his brother Ethelred in 871. The Danes were then masters of the coasts; but, by various success and treaties, he acquired a durable peace from 880 to 893, when new invasions kept him employed for four years. From 897 to 900 he enjoyed peace, and died after establishing a judicial system which has lasted to this day. He promoted learning and learned men, besides writing himself many excellent works.

ALI, the first disciple of Mahomet, and his son in-law, was assassinated, after being fourth Caliph four years and nine months. Mahomet was succeeded by Abubeker, Omar, and Othman, and the two last were also murdered. The Persians follow Ali, and the Turks Omar.

ALMAMON, the wisest of the Caliphs of Bagdad, was born in 786, and died in 835.

ALORUS, or ORION, the first of the 10 kings of Chaldea, whose dynasty was terminated by a deluge, from which Xisuthrus, the last of the 10, escaped in an ark from Sippara, or Babylon, into Armenia. Alorus is said by Apollodorus and Abydenus to have

reigned 10 sari, or 185 years, and to have given out that he was appointed by God to be the shepherd of the people. The ten reigned 2222 years, or 120 sari or revolutions of the Moon's nodes. The whole very remarkably resembles the first chapters of Genesis, its 10 patriarchs, &c.

The Astrological King of Castile was ALPHONSUS the 10th, who succeeded in 1252, and died in 1284. He spent 400,000 crowns on the Alphonsine tables.

Under the Duke of ALVA, Spanish Viceroy in the Netherlands, 1800 were executed in a few months, and 18,000 in a few years, besides as many more by the sword, all in the cause of religion.

AMBROSE, St., was Bishop of Milan, and died in 397.

AMBROSIUS, or EMRYS, was a British king, who, coming from Armorica, burnt Vortigern in his castle, and defeated Hengist and his adherents. Ambrosius being poisoned by a Saxon doctor, was succeeded by his brother Uther, surnamed Pendragon, who for several years maintained wars with the Saxons, and was the father of Arthur.

AMENOPHIS, is supposed to have been Memnon, Sesostris, or Vexones, and to have been the Pharaoh of Moses, who enslaved the Jews, and drove them out of Egypt.

AMMON, flourished 650 B. C.

AMPHICTYON, flourished 1500 B. C.

AMRU, a successful leader of the Saracens, and one of the founders of the Mahomedan empire, died 663

AMURATH I. was the founder of the power of the Turks, and reigned from 1357 till he was killed in 1390. He organized the Janisaries, and won 37 battles.

ANACREON, the Greek poet, lived in the sixth century B. C.

ANACHARSIS, a Scythian, who travelled in Greece, and invented the Potter's wheel. The fiction of his travels forms an interesting work of Barthelemi. He was put to death by his brother, for endeavouring to reform the laws.

ANAXAGORAS, an Athenian, who flourished in the fifth century B. C., taught that wind was owing to rarefaction; that the rainbow was owing to reflection; that the moon is enlightened by the sun; that comets are wandering stars; that the fixed stars are beyond the sun, &c.; many of them regarded as modern discoveries. He was persecuted and banished by the priesthood.

ANAXIMANDER, a Greek philosopher, who flourished in the sixth century B. C., taught that infinity of matter is the original cause of all phenomena, and that all things return into it. He made the first globe, and invented the sun-dial. He observed the obliquity of the ecliptic, and taught that the sun is 28 times larger than the earth. He thought stars animated by the divinity.

Anaximander and Thales directed, says Simplicius, their attention to the prolific vital nature of water; Heraclitus, to fire; Anaximenes, to air; and Anaximander, to motion: owing to their different views as intelligible, sensible, or proximate, asserting different things in words, but not such as are contrary to those who are competent to judge. Aristotle observes, that some assume prior, others posterior principles; and one appeals to reason, and another to sense, with little general difference.

ANAXIMENES, a Greek philosopher, who flourished in the sixth century B C., taught the infinity of air, or ether; that its activity was the cause of all things; and that it was in reality God. From it proceed fire, water, and earth, by rarefaction and condensation.

ANELLO, Thomas, a bloody leader of a short insurrection at Naples, in 1646.

ANTHONY, the first monk, died in 251.

ANTIGONUS, chief captain of Alexander, got Central Asia after his death, but quarrelled with Eumenes, whom he killed, and with Seleucus, whom he drove out of Syria; the other captains of Alexander united against him, and their vast armies meeting near Ephesus, Antigonus was defeated and killed in 299, in his 80th year.

There were thirteen Syrian kings of the name of ANTIOCHUS, between 230 B. C. and the empire of the Cæsars. The third was surnamed the Great: he began to reign 174 B. C. He joined Hannibal against the Romans, but being defeated by them, lost the chief part of his dominions, and was killed by a rabble while he was plundering a temple of Belus or Baal. His son was the Epiphanes, or illustrious, of the book of Maccabees, and taking Jerusalem in 168, he slew 80,000 Jews, and sold as many for slaves, setting up the statue of Jupiter in their temple.

ANTONINUS, the best of the Roman emperors, was born in 86, and succeeded Adrian in 138. His moderation secured general peace, and though he persecuted the Christians, he wrote some excellent works, and died at 75, after 23 years' reign. He was succeeded by his son-in-law, Marcus Aurelius, called the philosopher, and a pattern for all kings.

APELLICO, a Biblio-maniac of Athens, who bought MS., and made a vast library without reading it. He acquired fame as the rescuer of Aristotle's works, for which he gave a high price. When Sylla took Athens, he sent them to Rome.

APELLES, a Greek painter, who flourished in the age of Alexander.

APICIUS, the Roman gourmand, spent in a few years 807,000*l.* in luxuries of the table, and poisoned himself when he found that he had but 80,000*l.* left.

There were three APOLLONIUSES. One a great geometrician, who died 205 B. C. A poet, who wrote the Argonautics in Egypt. And the famous physician and astrologer, who died about the year 100, aged 97.

AQUINAS, St. Thomas, lived from 1224 to 1274, and acquired, for his ability in solving theological and logical conundrums, the name of Angelic Doctor, angel of the schools, &c. His disciples were called *Thomists*, and his works, often printed, are in seventeen volumes folio.

ARATUS, wrote a Greek astronomical poem, about 300 B. C., but his theories are very imperfect. There was also a celebrated commander of the same name.

ARCHIMEDES, a mathematician and mechanic of Syracuse; he was killed during an assault by the Romans, 212 B. C.

ARETINO, in 1070, invented the present musical notation, by applying to it the first syllables in the following verses—

UT queant laxis
REsonare fibris,
MIra gestorum,
FAmuli tuorum,
SOlve pollutis
LAbus reatum.

By these he converted the old tetra-chord into hexachords. He invented lines and spaces in musical notation.

ARIOSTO, a famous Italian poet, died at 59, in 1533.

ARISTIDES, an Athenian, was so eminent for his virtue, that in envy his enemies procured his banishment for ten years; but he afterwards defeated the Persians at Salamis, 478 B. C., and died honoured.

ARISTOPHANES, a Greek comic writer and poet, who lived about 350 B. C., and pandered to the enemies of Socrates.

ARISTOPHANES, flourished 400 B. C.

ARISTARCHUS, was a learned critic of antiquity; and Zoilus a carping insolent critic.

ARISTARCHUS, of Samos, lived in the third century, B. C., and Hipparchus of Nicea in the second century, B. C. They laid the foundations of European astronomy.

ARISTOTLE, was a justly-celebrated philosopher of Athens, founder of the school of the Peripatetics, and tutor of Alexander the Great, who had the merit of being grateful. Of course, his enlightened opinions differed from the ignorant priesthood and magistracy of Athens, but being protected by Alexander, his enemies durst not shew themselves till after the death of the king; but he was then obliged to retire from Athens. He died two years after, at the age of sixty-three; and, to secure his writings, they were conveyed to Ephesus, and secreted in a cellar. After 150 years, they were bought by a wealthy Athenian, and then sent to Rome by Sylla. In due time they were copied and published, and to them we are indebted for clear views of the surprising perfection of many branches of knowledge among the Greeks. ARISTOTLE and PLATO were rather commentators than inventors of new opinions, though they conferred greater perfection; and Plato defined the intellectual God; while Aristotle states, that every thing which moves must have an immoveable mover, the first principle of motion subsisting as a properly-producing principle, and as eternally motive. ARISTOTLE taught the principle of virtual velocities; and, also, that time, space, and a vacuum, were essential to motion, with the laws and varieties of which he was familiar. The energy of nature to fill up vacuities, he figuratively described as an abhorrence, but did not assert that there are no vacuities. ARISTOTLE taught five rules of conception, or perfect reflection, as follows:

1. To conceive of things *clearly* and *distinctly* in their own natures.
2. To conceive of things *completely* in all their parts.
3. To conceive of things *comprehensively* in all their properties and relations.
4. To conceive of things *extensively* in all their kinds.
5. To conceive of things *orderly*, or in a correct method.

Hence, every perfect idea includes clearness, completeness, comprehensiveness, extent, and order.

ARIUS, an early divine, who, about 300, denied the doctrine of the Trinity and the divinity of Christ; about which he divided the church.

ARKWRIGHT, (Sir Richard,) previously a barber at Bolton, and having a mechanical genius, in 1767 constructed a machine for carding and spinning cotton: the same thing having been effected by one Hargrave at Blackburn, whose machinery had been destroyed by a mob of hand-carders and hand-spinners. Having made his machine near Warrington, and taken out a patent, he removed to Nottingham to avoid mobs; but, succeeding well, his patent was impeached, and, on the evidence of the Hargraves, set aside in 1785. He had, however, set up other mills at Cromford, and dying in 1792, he left great wealth to his son, now the richest commoner in England.

ARMINIUS, or Hermann, a German, who, in the reign of Tiberius, expelled the Romans out of Germany, but was assassinated in 55.

ARMINIUS, a divine, flourished in 1600.

ARNE, an English composer of original merit, died 1778.

ARRIAN and APPIAN, two historical writers, flourished 115 A. C.

There were four ARTAXERXES, Kings of Persia. The opera is founded on the Third, called Ochus, who began his reign 364 B. C., murdering 80 of his brethren, and also Artabanes, but was finally poisoned by Bogoas, 319 B. C.

ARTHUR, a British King, who, in the 6th century, resisted the Saxons under Kerdric, and gained the battle of Badon, or Bath, in 520 or 30, and eleven others. He then joined the other nations under Totila, in driving in the Romans, and, during his absence in Italy, his nephew Medrawd, whom he left Regent, joined the Saxons; but Arthur returning with reduced forces, met his nephew and the Saxons at Camelford, when he was mortally wounded by Medrawd, whom he killed, and only three of his brave army escaped. This happened about 550. He instituted the Round Table at Winchester, with the following motto—"Spread be my board, round as the horizon and ample as my heart, that there may be no first or last; for odious is distinction, where merit is equal."

ATHENÆUS, flourished 215 A. C.

ATALIBA, King of Peru, was murdered by Pizarro, at Cusco, in 1533.

ATHANASIUS, author of the creed, was a native of Alexandria. He enjoyed little authority in his life, even among Christians, and died, in 371, in exile.

ATTILA, King of the Huns, (Hungary, Poland, &c.) in 441, over-ran Greece and Italy, and made Theodosius pay tribute. In 451, he invaded Gaul with an army of half a million, and besieged Orleans, but was defeated at Chalons with the loss of 200,000 men. He then plundered Italy a second time. He was called the scourge of God.

AUGUSTUS, nephew of Julius Cæsar, was born 62 B. C. At 20, he was made Consul and heir of Julius. He defeated Brutus and Cassius at Philippi in 41, and Mark Anthony and Cleopatra, at Actium, in 32. Twice he offered to restore the Supreme Power to the senate, and, after being thirteen times Consul, died in 14 A. C., aged 76.

AUGUSTINE, St., was Bishop of Hippo, and died in 430.

AURENGZEBE, the most famous of the great Moguls, was born in 1618, and died in 1707. He was the third son of the Great Mogul Shah Jehan. Having murdered his elder brothers, he succeeded his father in 1659, and extended his empire over all India within the Ganges. He was a zealous Mahomedan, and sought to destroy the religion of Brahma.

AUSTIN, St., was first Archbishop of Canterbury, and died in 608, ten years after converting Ethelbert.

The two famous Arabian Philosophers were AVICENNA, born in 978, and AVERROES, born about 1130. The former was an Arabian, and educated at Bagdat—the latter was born at Cordova, but resided chiefly at Morocco. Both of them denied the possibility of a sudden creation and a particular providence.

Francis BACON, Lord Verulam, a very profound thinker for his age, and Lord Chancellor in 1619, in the reign of James I. In 1605, he dedicated his great work on the advancement of learning to James, and described him as "superior to Cæsar, Antoninus, or Hermes," for which he was raised to the highest dignities. During his ascendancy, the laws were passed for burning witches, and the great Sir Walter Raleigh was beheaded, after suffering fourteen years' imprisonment in the Tower. Being accused of taking numerous bribes from suitors, some of whom he ruined for making the accusation—to save his life he confessed the whole, and was sentenced by the House of Lords, to pay a fine of 40,000*l.* and banished London. He died in April, 1626. The sentence of the Lords was in the following terms—"That the Lord Viscount St. Albans shall undergo fine and ransom of 40,000*l.*; that he shall be imprisoned in the Tower of London during the King's pleasure; that he shall for ever be incapable of any office or employment in the State or Commonwealth; and that he shall never sit in parliament, or come within the verge of the court." His letters to Buckingham were mean and disgraceful; while, in philosophy, he opposed the Copernican system; believed in demonology and withcraft; and, such was his faith in astrology, that, owing to the Moon being lady of his ascendant, he used to faint during an eclipse, and, as he asserted, even if he did not know of it. He translated some of the Psalms, and the following is one of his verses, written in the age of Shakespeare:—

> The fishes there far voyages do make,
> To divers shores their journey they do take,
> There hast thou set the great Leviathan,
> That makes the seas to seeth like boiling-pan.

The chief design of his writings is to prove the necessity of studying nature by means of experiment, a system which had then began to prevail in Italy under Bruno and Galileo; in England under Gilbert; and, in France, under Gassendi.

Roger BACON, was an experimental philosopher, who was born at Ilchester in 1214, to whom the world is indebted for some discoveries and the germs of others. He died in 1292, after suffering two imprisonments, and one of ten years, for "holding communion with the devil and being an atheist."

BAILLY, a learned Frenchman and astronomer, author of Letters on the Origin of the Sciences, and on Plato's Atlantis, (both meriting English translation) but mixing with politics in the heat of the revolution, and, as Mayor of Paris, directing the military to suppress a riot, by which many were killed, was, for the same, barbarously guillotined by the revolutionary tribunal in 1793.

BAJAZET I., son of Amurath I., succeeded his father in 1389. He over-ran Asia Minor, Bulgaria, and Servia, and, besieging Constantinople, was attacked by a Christian army of 100,000, which he met and defeated with terrible slaughter at Nicopolis; he afterwards met Tamerlane, the Tartar, at Angora, in 1402; and, after a murderous conflict of three days, in which 340,000 were slain, Bajazet was defeated and taken prisoner; he died nine months after, of an apoplexy.

Elizabeth BARTON, was the name of the holy maid of Kent, an epileptic impostor, of whom the clergy made use of to deter Henry VIII. from his quarrel with the Pope; but he ordered her to be taken up, when she confessed all, and, in consequence, several dignified clergy were hanged; and Bishop Fisher, and some others, deprived and imprisoned.

BARBAROSSA, was the son of a potter, who, joining some pirates with his two brothers, soon became Admiral of a fleet, and, seizing Algiers, obtained the sovereignty of that city and the adjoining country; but he was overpowered by a general confederacy two years after, and killed in battle, in 1535.

BAYLE, Peter, the celebrated writer of a great and learned Historical Dictionary, born in 1647, and died in 1706.

BAYARD, Chevalier, was born in 1476, and, after various romantic achievements, was killed in 1524.

Cardinal BEAUFORT, was son of John of Gaunt, by Catharine Swinford, sister-in-law of Chaucer; he died in 1447.

Cardinal BEATON, was a zealous supporter of the Romish Church while the Reformation was spreading in Scotland; and, having brought Wishart, a popular preacher, to the stake, he was assassinated in his own castle, in 1546.

Thomas à BECKET, a factious and arrogant churchman, who was killed in 1170, at Canterbury.

The Marquis BECCARIA, an eminent modern Italian writer, was born in 1755; he published on crimes and punishments, and on political economy, and died in 1793. There was, also, FATHER BECCARIA, an eminent natural philosopher, born in 1716; he made many discoveries in electricity and other branches of natural philosophy, and died in 1781.

BEDE, an English historian, flourished at the end of the seventh century.

BEDFORD, Duke of, a son of Henry IV., who, as Regent of France, burnt the maid of Orleans in 1431, by which atrocity the English interests were ruined in France.

BEETHOVEN, composer, died 1827.

BEHMEN, Martin, gave its name to Patagonia, in a voyage of discovery about 1480; he was afterwards treated with great distinction in Portugal; and at Nuremberg, his native city, he constructed a globe still in existence, and on which he depicted his own discoveries before the voyage of Columbus. It seems, too, that his discoveries were well known to Columbus and Magellan; he died in July 1506, at Lisbon.

BELISARIUS, commanded the victorious armies of Justinian, the Eastern emperor, from 529 to 561; but, exciting jealousy, he was reduced to extreme poverty, though some say he was restored before his death, in 565.

There were two BELSHAMS, William the historian, and a very amiable man, who died in 1827; and Thomas his brother, a Unitarian minister, of great ability and sound learning, who died in 1829.

There have been thirteen Popes who took the name of BENET.

BENEDICT, was an Italian, born about 480, and founded his order in 543.

BERENICE, whose hair is a constellation, was sister and wife of Ptolemy Euergetes, and killed by her son 220 B. C.

BERGMAN, a chemist, born in 1735, and died in 1784.

BERKELEY, Bishop and Philosopher, born in 1684, and died in 1753. He maintained that the existence of matter was purely ideal, and supported this by certain inferences of the mind during vision; he thought it necessary to expel matter from nature, to destroy scepticism and impiety.

BEROSUS, a Chaldean philosopher, who came to Greece after the death of Alexander, and wrote various works.

BERTHOLLET, a chemist, died in 1822.

BERWICK, Duke of, was son of James II. by a sister of the Duke of Marlborough, and was killed in the field, in 1734.

BERNARD, was a preacher in favour of the Crusades, and a zealous stickler for the rights of the Church between 1131 and 1160, when monks ruled the world.

BERTHOLD the Black, or Schwartz, whose real name was Anklitzen, was the discoverer of that mischievous compound Gun-powder; and a monk, who, mingling the ingredients for a medicine in a mortar, and laying a stone upon it, it caught fire by his striking a light near it, and blowing up the stone with violence, the idea of cannon was suggested. It was first patronized by the Venetian government, and they employed the first cannon in the battle of Chioza, in 1318.

James and John BERNOULLI, commonly called *the Bernoulli*, were two very eminent mathematicians, natives of Basle, born about the middle of the seventeenth century. James died in 1705, and John in 1748. Daniel, the son of John, born in 1700, trod in the steps of his father and uncle, and died in 1782.

BICKERSTAFF, Isaac, author of Love in a Village, the Maid of the Mill, Doctor Last, Romp, Lionel and Clarissa, &c. died in 1776.

BICHAT, the French physiologist, was born in 1771, and died in 1820, having laid new foundations for the theory of animal phenomena.

BILDERDIJK, the most universal of modern scholars and poets, was born in Holland in 1756, and died 1831.

BILLAUD, Vareunes, the most sanguinary member of the Committee of Public Safety; he escaped to the United States, and died about 1816.

BLACK, an eminent chemist, was of Irish family, and born at Bourdeaux; he received his education at Glasgow, and was elected Chemical Professor at Edinburgh in 1766; he was the promulgator of an hypothesis, that heat is a peculiar fluid, sometimes active, sometimes latent; he died in 1799.

BLACKSTONE, an English Judge, born 1723; died 1780.

Admiral BLAKE, the most heroic of English admirals, was born at Bridgewater in 1599. Thwarted in obtaining a fellowship at Merton College, he joined the Puritans, and was returned M. P. in 1640. In 1642, he raised a troop of dragoons; and, in 1644, surprised Taunton, of which he was made governor, and afterwards defended it against 10,000 royalists for some months. In February, 1649, he took the command of a squadron to act against Prince Rupert, and distinguished himself at Kinsale, the Tagus, Carthagena, and Malaga. In 1652, he commanded against Van Tromp, De Witt, and De Ruyter, and fought some signal naval battles; he afterwards attacked the Barbary States, and, in his voyage home, died in August, 1657.

Queen BOADICEA, was the daughter of

the King of the Iceni, (now Norfolk and Suffolk.) Her father had borrowed money of Roman usurers, one of whom appears to have been *Seneca*, the too-rich philosopher; these creditors oppressed the king and his daughters, and a general insurrection was the consequence. Boadicea took Augusta, (now London,) and destroyed the ninth and other legions, and above 40,000 (some say 70,000) of the Romans and their partizans. In the meantime, the Romans assembled their forces, and Boadicea and the Icenians were routed with great slaughter; and she, being taken prisoner, soon after died.

BOCCACIO, an Italian writer, author of Il Decamerone, died in 1375.

BODE, author of the Celestial Atlas, containing 17,240 stars, died in 1826.

Sir Thomas BODLEY, founder of the Library at Oxford, was born in 1544, and died in 1612.

BOERHAAVE, the modern Hippocrates, was born in 1668. He reformed medicine, and expanded its philosophy more than any other modern; he died in 1738.

BOETHIUS, was prime-minister to Theodoric, King of the Goths, in 510, and preserved the Greek books during that king's conquest of Greece.

BOILEAU, a French poet, died 1711.

There were eight sovereigns of Bohemia and Poland, of the name of BOLESLAUS, in the 10th, 11th, and 12th centuries.

Lord BOLINGBROKE was born in 1672. In 1704, he became Secretary-at-War, and, in 1710, was Secretary of State. Being a suspected Jacobite, he lived abroad till 1723, and afterwards at Battersea, in association with Pope and the Literati, till he died, in 1751.

BOLIVAR, the Washington of South America, and founder of three republics, was born in 1783, and died, at the head of the Columbian Republic, in Dec. 1830. Bolivia is called after him; he established the independence of Peru.

St. BONIFACE, was a native of Crediton, who, preaching his religion in Frieseland, was killed, with 60 of his followers, in 753.

There have been nine popes of the name of BONIFACE; the 8th, elected in 1294, dictated to all the kings in Europe, and, in 1301, he placed France under an interdict; but, being seized by the French party of the Ghibelines, he died, of a phrensy, in 1303; he instituted the Jubilee of 50 years.

The bloody Bishop Bonner under Mary, was deprived and imprisoned by Elizabeth, till his death, ten years after.

BOSSUET, Bishop of Meaux, an eloquent French preacher, died in 1704.

BOSCOVISH, commonly called *Father*, because he was of the order of Jesuits, was an eminent mathematician, and the author of some philosophical hypotheses in the last century; he died in 1787.

The Hon. Robert BOYLE was a distinguished theological writer, and philosophical experimentalist, who flourished in the 17th century. To his influence, while residing at Oxford, the world are indebted for the germ of the Royal Society, of which, in London, he was a member; he was a successful experimenter with the air-pump, then recently invented, but his writings are mixed with gross superstitions; he gave credit to Greatorex the stroker, and even to the pretensions of alchemy. His contemporaries, in the Royal Society, were such men as Aubrey, Ashmole, Moore, and Glanville, who were devoted to astrology and divination; he died in 1691, aged 65.

Joseph BRAMAH, the engineer, was born in 1749, and died in 1814; he took out 20 patents for most ingenious—and some of them memorable—inventions.

BRADSHAW, a native of Cheshire, and president of the court which condemned Charles I., died in November, 1659.

Tycho BRAHE was a Danish gentleman, born in 1546, who devoted himself to astronomy, and was the preceptor of Kepler; he imagined a system in contrariety to that of Copernicus, in which he placed the Earth in the centre, the Moon next the Earth, with the Sun at a distance, making Mercury and Venus the Sun's two satellites.

BRENNUS and BELINUS, two British princes, who, in 365 B. C., led armies of Britons, Gauls, &c. against Rome, and, defeating the Romans, sacked the city; and afterwards, in Greece, took Delphos. The Bards and Druids, as well as Geoffrey of Monmouth, record these achievements, and Plutarch, Chap. VII. Book 3, speaks distinctly of it, while others say they came from the extreme west. Billingsgate is said to be called after this Belin, and his name occurs in Nennius.

There were three BREUGHELS, painters, the Droll, the Hellish, and the Velvet, from their subjects and styles. The two last died in 1642.

BRIGGS, Henry, the inventor and calculator of the Logarithms in general use, died in 1630.

BRISSOT, a philosophical politician, sacrificed by the Robespierrian party, October, 1793, with many friends.

BROOKE, Henry, a polite writer, of superior genius, died in 1783.

Mrs. BROOKE, a woman of superior talents, was conductress of the Opera-house, and wrote Rosina, and other dramas; she died in Canada, about 1790.

BROWNE, Sir Thomas, author of a work on Vulgar Errors, but was himself, in 1664, witness in support of a trial for witchcraft, at Bury, before Sir Matthew Hale, by whom two victims were in consequence burnt; he died in 1682.

Robert BRUCE, the Hero of Scotland, and successor of Wallace, as a defender of the country against the pretensions of Edward I., was crowned at Scone, March 27. 1306; his prowess, and that of Wallace, are deservedly favourite themes, and the battle of Bannockburn having fixed his power, he reigned 23 years, dying at Cardross, on the 7th of June, 1329, in his 55th year.

BRUCE, the African traveller, was born in Scotland, in 1730, and educated at Harrow; he was at first a wine-merchant, but,

having studied Arabic and Coptic, he was appointed Consul at Algiers, and, under the sanction of the Dey, he performed his travels in Asia and Africa, and visited Abyssinia and the sources of the Nile. Bruce has been verified in the late government survey of the Red Sea, by Wellstead; the differences are only a few minutes. For example, Bruce makes the lat. of Kosair 26° 7′ 51″, and long. 34° 4′ 15″; Wellstead, lat. 26° 6′ 59″, and long. 34° 23′; Yembo exactly agrees, lat. 24° 3′ 35″; Koheido, per Bruce, 14° 48′; per Survey, 14° 46′ 30″; Mokha, 13° 20′, and 13° 19′ 55″; and Massowah, 15° 35′ 3″; Survey, 15° 33′ 56″.

BRUNO, the founder of the Carthusians, died in 1101.

The Guelphs are descended from BRUNO, brother of Wittikind, King of the Saxons, who, in 785, swore allegiance to Charlemagne; and, in time, they became Earls of Althop and Dukes of Bavaria.

BRUTUS, a Trojan Prince, who, after the burning of Troy, collected the Trojans, and established colonies on the Loire; and then, landing at Totness, established that race of princes from whom Henry VII. and the present Royal Family of England claim descent.

There were two famous BRUTUS's: one Lucius Junius, the grandson of Tarquin the Proud, whose son having violated Lucretia, Brutus roused the people to expel the family, and was himself made Consul, in the year 500 B. C. The adherents of the royal family conspired against the change, and among them were Titus and Tiberius, the two sons of Brutus, who, refusing to protect them, they were beheaded while he sat as Consul; he was afterwards killed, in a battle with the Tarquins, by one of the king's sons.—The other BRUTUS was Marcus Junius, who was believed to be a natural son of Cæsar, by the sister of Cato; he took part with Pompey, but was forgiven by Cæsar, and promoted to a government; he was afterwards made first Prætor, but he joined the conspirators in killing Cæsar.

Jacob BRYANT, a learned expounder of ancient mythology, and a very able archæologist, was born in 1715, and died in 1804.

George BUCHANAN, a Scottish man of letters, was born in 1506, appointed tutor to James VI. in 1565, and died in 1582.

John BUCKHOLD, a butcher of Leyden, was the fanatic leader of the Anabaptists, who, in 1533, committed such atrocities in Munster, announcing the millenium!

BUFFON, the very distinguished modern philosopher, was born in 1707; his first study, like that of all successful scholars, was mathematics, and, having an income equal to 12,000*l.* a-year, he was enabled to indulge his passion for learning. In 1749, he published the first volume of his famous Natural History; he died in 1788.

Sir Thomas BULLEN was a statesman and ambassador of talent for Henry VIII., and created Earl of Wiltshire; his daughter Anne married Henry VIII. in 1532, bore Elizabeth, afterwards the Queen, and was beheaded May 19, 1536, and, two days after, her brother George, and three of her friends; the tyrant next day marrying Jane Seymour.

John BUNYAN, was an ingenious enthusiastic writer in the 17th century, and his works are exactly adapted to the class of minds who are susceptible of religious fanaticism; he was a tinker in a village near Bedford, and most cruelly treated by the intolerant government of Charles II., by being imprisoned, for twelve years and a half, in Bedford gaol.

The celebrated Michael Angelo, whose family name was BUONAROTTI, was born in 1474, and became the greatest sculptor, painter, and architect of his age; he built St. Peter's at Rome, and many other beautiful buildings in that city.

Edmund BURKE, who made so great a figure in English politics, and, moreover, was so eloquent a writer, was a native of Dublin. In 1753, he came to London as an adventurer, and lived by writing for the booksellers: he afterwards edited the Annual Register, and, in 1761, obtained a pension of 300*l.* a-year; he then found a patron in the Marquis of Rockingham, and acted with the party of the Whigs. In 1785, he impeached Hastings, and made a great display of vituperative eloquence. At this time he wanted money, for his liberal patron died in 1782; he expected his party to subscribe for him, as they did for Fox and Grattan, but, being frustrated, he exerted his pen in defending the old monarchies of Europe, for which unexpected service he obtained a pension of 3000*l.* per annum; he died in July, 1797.

BURNS, the inimitable Scottish poet, and one of the most independent and original geniuses which that country has produced, was born near Ayr, in January, 1759. Poorly educated, and employed in farming-labour, in July, 1796, he died of a broken constitution; and that honour is now bestowed, which, alas! is too late to cheer the aspiring poet.

There were two BURNETS, nearly cotemporary, and often mistaken. Thomas, the elder, was a Yorkshireman, and wrote a theory of the earth, highly ridiculous, and some other works, and died in 1715; but Gilbert was born at Edinburgh, and distinguished, in the reign of Charles II., by his friendly connection with the partizans of liberty: attending, as a clergyman, on Lord Russell, at the scaffold. He wrote a History of the Reformation, and was one of the instigators of the Prince of Orange, with whom he landed at Torbay; he was made Bishop of Salisbury, and died in 1715, much respected by honest men.

Hudibras, the best picture of human life and passions ever drawn, was written by Samuel BUTLER, a native of Worcester, and educated at Cambridge; he lived neglected till his 68th year, and died in 1680.

BUXTON, Jedediah, an untaught labourer, in five hours gave the 8ths of the cubic inches in a solid 23,145,789 yards long, 5,642,732 yards broad, and 54,965 yard

thick, by means of a calculation which he could never explain.

The BUXTORFS, father and son, learned Hebraists, were of Basle in the 16th century, and edited numerous works.

BYRON, Lord, a distinguished British poet, who will rank second only to Pope, in the records of British genius; he wrote much in his short career of eighteen publishing years, and died at only 39, in 1824, after a life of mental anxiety and adverse adventure; yet every stanza, true or false in sentiment, bespeaks a maturity of mind such as few writers, ancient or modern, have displayed; he was as popular as Scott, though totally independent, and regardless of all parties, for in a great community there are enough to patronise opposites. Concentration of thought, and strength of expression, distinguish him from all other poets; and hence, like Shakspeare, he is a writer for all times.

CABOT was a British nautical discoverer, between 1525 and 1550.

CADMUS, was a Phœnician, who built Thebes, about 1520, and introduced sixteen letters to the Greeks, to which Palamedes and Simonides added four others.

CADWALADER, a British king, who, after the treachery of the Saxons, abdicated to his son, Idwal, whose descendants retained Cornwall till 750, and Wales till the age of Edward I.

Julius CÆSAR, was born 100 B. C., of the ancient Julian family. In youth he was a fop, a debauchee, a spendthrift,—afterwards an intriguer. Marius was his uncle, and he married Cornelia, the daughter of Cinna; and, on her death, Julia, the daughter of Pompey the Great, with whom, and Crassus, he formed, in 60, a triumvirate, opposed by Cato, Cicero, and the Republicans. In 58, Pompey became pro-consul in Spain, &c. Crassus in the East, and Cæsar in Gaul and Germany. In his eight years' wars against the Gauls, Germans, Helvetians, and Britons, three million men were slain. On the senate ordering the disbanding his army, in 49, he marched into Italy, entered Rome, and seized the treasury; he followed Pompey and the senate into Greece, and at Pharsalia, in 48, defeated them, and followed Pompey into Egypt, where he had been assassinated; Cato, Scipio, and others into Africa, where Cato, in despair, killed himself; and then defeated Pompey's sons in Spain. In 45, he took the title of *Imperator*, and perpetual dictator, but the republicans, Brutus, Cassius, Cimber, Casca, Cato, Scipio, and sixty others, united to destroy him, as a public enemy; and, in five months, March, 44 B. C., he was slain in the senate-house, receiving twenty-three wounds, and being pronounced by Cassius "the worst of men." Marc Antony, his confederate, however, availed himself of Cæsar's popularity with the soldiers and the mob, to whom Cæsar had been very prodigal, and obliged the patriotic senators to leave Rome, when civil wars ensued, which ended in Cæsar's nephew, Augustus Octavius, obtaining, in 29, the power of Cæsar, which descended in a line called Cæsars, the most odious monsters, with two or three exceptions, that ever disgraced and afflicted humanity. Julius Cæsar was, in person, like Pope, the poet.

John CALVIN, or CAWVIN, the Reformer, was born in 1509. He was, at first, a Romish priest, but adopting the principles of the Reformers, he fled to Basle. Here he composed and published his Institutes, in 1535. In 1540, he settled at Geneva, and his labours were wonderful. The homage paid him was so great, that one Gruet was beheaded in 1547, for speaking against him, as alleged impiety; and, in 1553, Dr. Servetus, who had written against the Trinity at Vienna, fled to Calvin, but he caused Servetus to be arrested, and he was in consequence burnt alive at Geneva, while Calvin's influence dictated every opinion of the magistracy, Bucer, Beza, and Melancthon, being said to have approved. He died Feb. 24, 1564, eleven years after the horrible death of Servetus. Calvin for several years wrote 286 sermons, and 186 lessons, and, to effect this, abstained from dinner for ten years. He died in consequence, at 55, afflicted with infirmities; but his followers are still numerous, especially in Great Britain, both in the Church and among dissenters.

CAMBDEN, an English antiquary, was born in 1553, and died in 1623.

CAMOENS, the Portuguese author of the Lusiad, was born in 1715, and died in 1779. His poem is an incongruous mixture of ancient and popish mythology.

CAMILLUS, M. F., a Roman Republican of the 4th century B. C., who took Veii after ten years' siege, and twice repulsed Brennus and the Gauls.

CANOVA, a modern sculptor, of transcendant merit, died in 1822.

CANNING, George, a parliamentary orator, from 1796 to 1827, when he became minister, but died soon after.

There were three CARACCIS, very eminent painters, all born at Bologna, and flourishing in the same period. Annibale, the most eminent, was born in 1560, and died in 1609. His brother, Egostino, was born in 1558, and died in 1602; and Ludovico, their cousin, was born in 1555, and died in 1619. Their works, which are of the first order of merit, created a school of art, called the Bolognese.

CAROLAN, the modern Irish bard, died in 1738, in his 68th year. To his original genius we are indebted for those beautiful Irish melodies which have been harmonised by Sir John Stevenson, and provided with words by Mr. Moore. His instrument was the Irish harp.

CARADAWG, or CARACTACUS, was the British prince who resisted the arms of Claudius and his generals; but, being betrayed, he was taken before the Emperor, and extorted the liberality of Claudius. But his whole family were kept as hostages, by the jealous Roman tyrants.

CARNOT, a distinguished French Republican, was one of the memorable committee of Public Safety, who successfully resisted the invasions and intrigues of the Allied Sovereigns of Europe. He died in Prussia, in voluntary exile, in 1823.

CARTWRIGHT, Major, a British patriot, and one of the fathers of Parliamentary Reform, died in 1824. His brother Edmund was an original inventor of very important manufacturing and agricultural machinery, and both of them were men of rare merit and virtue.

CARDAN, was an astrologer and mathematician, who died at Rome in 1576.

There were three CASSINIS, grandfather, father, and son, all eminent mathematicians and astronomers. John was born in 1625, and died in 1712; James was born in 1677, and died 1756; and Cæsar Francois was born 1719, and died of the small-pox in 1784. Hence, for 150 years, the name of Cassini was in high estimation throughout Europe.

There were several distinguished CASSIUSES. The friend of Brutus, and leader of the confederacy against Cæsar, was called Longinus, and was a man of learning.

Lord CASTLEREAGH, Marquis of Londonderry, was a statesman, who flourished between 1794 and 1819, during which he filled high offices, and distinguished himself by his enmity to Napoleon, so as to have been a chief instigator of those fatal wars. In April, 1815, Napoleon, to avert the pending hostilities against all Europe, offered to Castlereagh the renewal of the commercial treaty with France of 1786, as the price of England's forbearance, an offer which was scorned, Lord C. stating, that the same treaty could be got from the Bourbons. But, in 1818, Castlereagh tried the Bourbons, and Canning was sent to Paris, but in vain; and the affair, as is asserted, so wounded the pride of Castlereagh, that he destroyed himself.

CASWALLAWN, was the British prince who opposed Cæsar, whose forces he had attacked in Gaul, to rescue the Princess Flur, to whom he was betrothed, and who had been betrayed to Cæsar by a Prince of Gascony.

CASTOR, after whom a star in Gemini was named, was one of the Argonauts, about 1260 B. C.

CAXTON, W., was a London mercer, who in Germany learnt the new art of printing, and introduced it into England, printing about fifty or sixty books in twenty years; he died about 1492.

CATHARINE DE MEDICIS, was born at Florence, in 1589, and married Henry the Second of France, by whom she had three sons, Francis, Charles, and Alexander, all kings; and three daughters, all queens. She died in affliction, in 1589.

There were two CATOS; one the Censor, the sworn enemy of Carthage; and the other his grand-nephew, who killed himself at Utica, to escape from Cæsar.

CATHERINE II., late Empress of Russia, was one of the most successful women that ever sat on a throne. She was born in 1729, and in 1744 was married to the Grand Duke Peter, heir-apparent to the throne of Russia, who was a pusillanimous and debauched character. On the death of Elizabeth, in 1762, on the pretence of various personal affronts, she headed a conspiracy of nobles and military men, who contrived to get her proclaimed Empress in Petersburgh; and Peter was imprisoned as well as Prince Ivan, both of whom soon died of diseases, to which dethroned princes are very liable. She died in November, 1796, aged 67.

The Hon. Henry CAVENDISH, a successful modern chemist, was born in 1731, and died in 1810. Scheele and Priestley having discriminated the characters of gases, Cavendish, in 1776, discriminated hydrogen or inflammable gas, and ascertained that it is the principal component of water. He also ascertained the composition of nitric acid.

The father of William CECIL, Lord Burleigh, was Master of the Robes to Henry VIII. The Protector, Somerset, made the son Secretary of State in 1549, and, on the execution of Somerset, Burleigh was sent to the Tower, but released, knighted, and again made Secretary. He retired in Mary's reign, but Elizabeth made him her first Privy Councillor and Secretary of State. In 1571, he was created Baron Burleigh, and made Lord Treasurer. He was Elizabeth's minister till his death, in 1598, aged 78.

CELSUS, a Roman philosopher, flourished in 180, A. C.

CERVANTES, author of Don Quixote and many other works, was born in 1547, and, after a life of misery and care, died in poverty, in 1516, the same day that Shakspeare died at Stratford.

CHAMPOLLION, an expounder of the Egyptian hieroglyphics, by which he opened new views of ancient history and chronology; he died at Paris in 1831, while he was preparing his Egyptian travels.

CHARLES the Vth, Emperor of Germany, and King of Spain, was born in 1500, and died in 1558, after a bustling and intolerant reign of 38 years.

CHARLEMAGNE, Emperor of the West, whose dominion extended from the Baltic to the Mediterranean, was born in 742, and died at Aix-la-Chapelle, in 814

CHARLES MARTEL, was Mayor of the Palace to the King of France, and in 717 usurped the government, and gained many victories, especially one over the Saracens, near Tours, in 732, by which he arrested their progress in Europe.

CHARLES the XIIth of Sweden, became king in 1702, and lived in continual wars; but, in 1718, was killed at the siege of Frederischal.

CHAUCER, the earliest of our poets, and a man of extraordinary genius, was born in Bread Street, London, in 1328. He married a sister of the mistress of John of Gaunt, who, on the death of his princess, married her, and her descendants were the subsequent royal House of Lancaster; he died in 1400.

Thomas CHATTERTON, whose short

tragical story makes a figure in literary history, was born at Bristol, in 1750. His father had an employment in Redcliffe church, and a room in its tower contained some chests bequeathed to the church in the 15th century; the contents of which were MSS. Chatterton's father, who kept the keys of the belfry, used to purloin these MSS. for various waste purposes, which exciting the attention of young Chatterton, he made himself master of their character, and, transcribing some of them, published them.

CHIRON, was one of the earliest and most eminent of the philosophers of Grecian antiquity, and, at the foot of Mount Pelion, he instructed all the youth who became the heroes of the age, which Homer and others celebrate as Achilles, Ajax, Jason, Ulysses, Theseus, &c. &c. He was not less celebrated in the gymnastic arts than in the sciences; and, writing on horses, he was called a Centaur, and said to be a native of the country of the Centaurs, meaning Tartary or Bactria, whence the sciences were no doubt brought into Greece. His disciple Musæus assigned him a constellation as a Centaur, and it is believed that he himself made or imported the first celestial globe. He lived to nearly 100.

CHILLINGWORTH, a metaphysical divine, died 1644.

CHRISTINA, daughter of Gustavus Adolphus, succeeded him at six, in 1632; and, in 1654, resigned her crown, living in Italy and France, till 1689, in eccentric intercourse with artists and literati.

CHRYSOSTOM, St., died in 407.

CHUBB, Thomas, a powerful Deistical writer, died 1747.

CHURCHILL, Charles, an English Satirist, in whose Prophecy of Famine is a just picture of the Lowland Scotch; and, other pieces, strong exposures of political corruption; he died in 1764.

Colley CIBBER, was a dramatic writer of great merit, whose Hypocrite is a standing favourite; he died, aged 87, in 1757. He had a son, Theophilus, married to Dr. Arne's sister, afterwards a celebrated performer.

CICERO, Marcus Tullius, was born 105 B. C., and educated by learned Greeks. After displaying his unparalleled powers, as an advocate, he was quæstor in Sicily. At 40, he became prætor at Rome; and, at 43, consul. At 56, he was pro-consul in Cilicia, where he joined Pompey against Cæsar. At 61, he divorced his wife, and married his rich ward to pay his debts. At 64, he was proscribed by Mark Anthony, pursued, and murdered. The Oxford edition of his unrivalled works is 10 vols. 4to.

CINCINNATUS at Rome, and CIMON at Athens, flourished about 448.

CLARKE, Dr. S., a metaphysical divine, died 1729.

CLAUDE LORRAIN, a famous landscape painter, died 1682.

CLARENDON, Lord, an English historian and chancellor, who died 1673.

CLEOPATRA, the last of the family of Ptolemy Lagus, was the mistress of Cæsar and Mark Anthony, on whose death she committed suicide, in her 39th year.

CLIVE, Lord, a rapacious English general, who established the sovereignty of the East India Company over Bengal, by the victory of Plassey, in 1758.

CLOVIS, the first King of France, became a Christian at the instigation of his wife in 493; he fixed the government at Paris, and died at 45, in 511.

COKE, Sir Edward, a lawyer, was born 1550. In 1592, he became attorney-general, and was ultra-malignant against Essex and Raleigh, while the Gunpowder Plot gave full scope to his forensic insolence. In 1606, he became chief of the C. P., and in 1613 of the K. B., but, in 1616, was removed. In 1621, he was sent to the Tower, but afterwards framed the petition of right. He died in 1634.

Christopher COLUMBUS, the presumed discoverer of America, was born at Genoa, in 1447. His family were sea-faring, and he received suitable education for that employment. In 1467, he explored Iceland, for recent Portuguese discoveries, and the voyage of Martin Behmen, who really was the first discoverer of America, had directed attention to these objects. It was evident that if the world was globular, sailing westward must bring a voyager to the East Indies. To sail to the East Indies was, therefore, Columbus' object; but, in his route, he fell midway upon the Bahama Islands and the continent of America. Court intrigues and envy diminished his satisfaction and reward, and he died at Valladolid, in Spain, partly of chagrin, in his 59th year. His family-name was Colon.

COLLINS, poet, died 1756.

COLLINS, Anthony, a metaphysical writer, died 1729. He taught that a man can do as he wills or pleases; but that he is determined by his reason and his senses, *i. e.* differently from the absolute necessity of mechanics or physics.

COLBERT, a celebrated French minister, died 1683.

CONFUCIUS, the Chinese philosopher, called Kan-too-tse by the Chinese, was born about 550 B. C. He taught the people to submit to Providence, to love their neighbours, and restrain their passions. In physics he taught, that of nothing nothing can come; that matter has existed from all eternity; that the universe is an animated system of one material substance, and one spiritual being, into which every thing returns. His practical duties, to render men acceptable to heaven, were filial piety towards parents and ancestors, and obedience to the emperor and laws. With this wisdom he mingled faith in good and evil genii, and presiding spirits and angels with confidence in astrology and divination, by casting lots. The philosopher who preceded Confucius was Las-tye; he taught a Supreme Being, and that those who seek him must reject riches and dignities, avoid care, keep silence, and be compassionate.

CONDORCET, the eminent French philosopher, was born in 1743, and to him we are indebted for the calculi of probabilities, and on the truth or falsehood of decisions in mixed assemblies, making a majority of 9 in 61 votes as the nearest approximation to truth. At the revolution, he espoused the republican interest; and, being implicated with the Brissotine party, he died a fugitive, in March, 1794.

In French history there were two celebrated Princes of CONDE, one the leader of the Huguenots, who was killed at Jarnac, in 1569; the other born 1621, who, after various successful commands, died in 1686.

CONGREVE, W., a spirited English dramatist, author of Love for Love, the Mourning Bride, &c., died in 1729.

CONSTANTINE, commonly called the Great, was born in 272. His father was Constantinus, a partner in the empire with Galerius, but his mother was the daughter of an inn-keeper, of the name of Helena, who having, in her father's inn at Colchester, acquired a knowledge of Christianity, imbued her son with respect for the Christians. He became emperor at York, in 306. In the 20th year of his reign he put to death Crispus, his eldest son, and his own wife Fausta, and having removed the empire to Constantinople, he died in 337, being baptized on his death-bed by Eusebius. His mother, called St. Helena, who died unmarried, built a chapel at Jerusalem, and was buried there.

Captain James COOK, the celebrated circumnavigator, was born in 1728, at Marton, in Yorkshire. In August, 1768, he sailed in the Endeavour to Otaheite, to observe the transit of Venus, and surveyed New Zealand, and part of New Holland. In July, 1772, he sailed with the Resolution and Adventure; visited New Zealand, the Society Islands, Middleburgh, Amsterdam, the Marquesas, the New Hebrides, and discovered Norfolk Island, returning in July, 1775. In July, 1776, he sailed on a third voyage with the Resolution and Discovery, visited New Zealand and the Friendly Islands, discovered the Sandwich Islands, and explored the western coast of North America. He then visited the Sandwich Islands again, and left them; but, his ship springing a mast they returned, and a boat being stolen, he went on shore to recover it, when, in an affray, he and three marines were killed, and actually eaten by the savages, in the sight of the ships' crews, in February, 1779.

There were two eminent COOPERS, Lords Shaftesbury. The first a member of the long parliament, a Commander against the King, and Privy Councillor to both the Cromwells, and then a Commissioner for trying the Regicides, a Peer, and Chancellor of the Exchequer to Charles II. In 1672, he was made Lord Chancellor, but dismissed in 1673, and sent for thirteen months to the Tower. Soon after, he was the author of the Habeas Corpus Act; but, in 1680, was tried for high-treason. Being acquitted, he withdrew to Holland, and died in 1683; his grandson was the philosophical author of Characteristics, and other works, and died in 1713.

Nicholas COPERNICUS, or, in Polish, *Zoppernick*, was born at Thorn, in 1473, of a respectable family; and, after obtaining a Doctor's degree at Cracow, he studied mathematics at Bologna, and, at Rome, taught mathematics and astronomy. In 1516, he obtained a Canonry from the Bishop of Ermeland, and an Archdeaconry at Thorn. Here he compiled his system of the world, by contrasting the various opinions of the ancients with his own observations, in which he persevered for thirteen or fourteen years. Rather than be the victim of prejudices, he refused to publish, but allowed a friend to precede him; but his work excited little attention. In 1543, he printed his system at Nuremburg, but died a few hours after it was finished, in May, 1543. A few years since, Thorn and Frauenburg were explored for relics of this great man; his burial-place was discovered, and his bones found. Some trifling MSS., too, were recovered, and the Chapter erected a monument, with a bust and suitable inscriptions.

CORREGIO, the Italian painter, so much admired for the grace and delicate beauty of his productions, was born in 1494, produced his works at Parma, and died in 1534, in extreme poverty.

Ferdinando CORTES, the Spanish conqueror of Mexico, was born in 1485, and aided in the conquest of Cuba, in 1511, and in 1512 landed in Mexico with 5 or 600 ill-armed soldiers, and 10 small field-pieces; their standard being the cross. The Mexicans received them as friends, but the Spaniards soon contrived to quarrel with them, and committed the most horrible enormities; and, after sacrificing Montezuma, the Mexican Emperor, and slaughtering many thousands of the Mexicans, he became master of the country, and, returning to Spain, died in 1547.

CORELLI, a musician, died 1713.

CORIOLANUS, flourished 500 B. C.

COSTER, Lawrence, of Haarlem, was the first practiser of printing, in 1440.

CORNEILLE, a distinguished French dramatist; born 1606, died 1684.

COULOMB, a modern experimental philosopher, died in 1806.

COWPER, William, a pleasing poet, born 1731, died in 1800.

Thomas CRANMER, to whose perseverance England is indebted for the Reformation, was born in Nottinghamshire, in 1489. He was educated at Jesus College, Cambridge, and became D.D. in 1528. He recommended himself to Henry VIII., by writing in favour of his divorce; and, after going to Rome on the subject, in 1533, the King made him Archbishop of Canterbury. Soon after he passed the sentence of divorce, and, being threatened by the Pope, favoured the Reformation; he was always thwarted by Bishop Gardner, yet he constantly retained the protection of the King, who made him one of his executors. Under Edward

VI. he continued to forward the Reformation, but disgraced himself, like Calvin, by signing a warrant for burning two fanatics. In 1553, he was prosecuted by the Popish faction under Queen Mary; and, after suffering various indignities, was, in his 67th year, burnt at Oxford, as well as Bishops Ridley, Latimer, Hooper, and Ferrar, whose firmness and martyrdom established the Reformation.

CREBILLON, a French dramatist, died in 1762.

The admirable CRICHTON, was born in 1551, and left Saint Andrew's University highly accomplished in body and mind, in his 20th year; he was initiated in sciences, and master of twelve languages, besides excelling in all gymnastics and manly exercises. His attainments drew on him some jealousy at Mantua, and he was murdered in the street, in 1583.

CRŒSUS, the rich King of Lybia, overcome and dethroned by Cyrus, about 540.

Oliver CROMWELL, was born of a respectable family, at Huntingdon, in 1599. He was well educated, and settled as a gentleman-farmer at St. Ives, where his signature is still to be seen on the parish-books, as the first at vestry-meetings. The persecution of the Puritans conferring importance on them, he joined their sect, and was elected for Cambridge into the long Parliament. In 1642, he raised a troop of horse, and as M. P. was rapidly promoted. The victories at Marston Moor, Newbery, and Naseby, were chiefly gained by his intrepidity. In 1648, he forcibly purged the parliament, and was very instrumental in promoting the execution of the king. In 1649, he over-ran Ireland. In 1650, he defeated the Scotch armies at Dunbar; and, in 1651, Prince Charles, at Worcester. In 1653, he put a violent end to the long Parliament; and, six weeks afterwards, was proclaimed Lord Protector of the Commonwealth. After carrying on wars against Spain and Holland, he died at Hampton Court, of the ague, in September, 1658. He was interred with great splendour in Westminster Abbey; but, at the Restoration, his body was hung at Tyburn, with those of Ireton and Bradshaw; and their heads were placed over the gate of Westminster Abbey, where they remained till after the revolution; but Cromwell's skull being preserved, it was exhibited about 1810, as a curiosity.

CTSEBIUS, the inventor of pumps, and HERO, the inventor of windmills, were Rhodians, pupils of Germinus, in the first century, B. C.

CUDDWORTH, a metaphysical divine, born 1617, died 1688.

CUVIER, Baron, a distinguished French naturalist, anatomist, and geologist. His comparative anatomy is a work of the first authority, and he was enabled by this knowledge first to prove that fossil remains were of different genera and species from living animals. His labours created an epoch in scientific history; he died in 1832, at 64

CYRUS, called the Great, was born about 600 B. C.; and having dethroned his grandfather, and overcome Crœsus, took Babylon and founded the Great Persian Empire, extending from the Indus to the Euxine, and including both sides of the Red Sea. After shedding oceans of blood in his conquests, he marched into Scythia, and was slain in battle.

There were two CYRILS, one in 375 and the other in 475.

D'ALEMBERT, a French philosopher, born 1717, died October, 1783.

DANTE, the most powerful of the Italian poets, was born at Florence in 1265, and died in exile at Ravenna, in 1321. At an early age he was a popular magistrate of Florence, but in the re-action of parties he was banished, and passed the remainder of his life as a fugitive in other Italian cities. After his death, all Italy contended to do honour to his memory.

DANTON, an intrepid friend of civil liberty, and champion of France, when the free institutions established by the National Assembly were assailed by the royal family, and the orders who had been unprivileged, and by armed emigrants, supported by the courts of Europe, in 1791-2. On the receipt of the Brunswick manifesto, and the advance of the Prussians within 130 miles of Paris, the Stentorian voice of Danton aroused the populace of that city, and finally all France, into action; and the career of the confederated despots was arrested by prodigies of valour and self-sacrifices unparalleled in the history of the world. But, as the pedestal of popularity will not sustain two idols, so Danton and his party fell a victim to the jealousies of Robespierre and his party; and, by base pretences, he was guillotined April 5, 1794, three months before the re-action of parties brought on Robespierre and his associates a similar fate. Both had united to destroy the philosophical party of the Brissotines, and then both within a year destroyed one another. All this, and all the violences which accompanied the conflicts of parties in France, were direct consequences of the treaty of Pilnitz, by Russia, Prussia, Austria, and Spain; and the subsequent union of all the European courts in the same crusade, against the constitution of France.

DARWIN, poet and philosopher, died in 1802.

DAVID, Saint, flourished 540.

DAVID, King of Israel, flourished 1040 B. C.

DAVID, the head of the French school of painting, was a member of the Convention and Committee of Public Safety; he died at Bruxelles, in 1825.

DAVY, Sir Humphrey, the most original and able chemist of his time, and a most ingenious and industrious experimental philosopher. He was born in obscurity in Cornwall, in December 1778, was president of the Royal Society from 1820 to 1827, and died at Geneva, in May 1829; the same year

which deprived the sciences of Young and Wollaston.

DEE, Dr., was a mathematician and astrologer, who also pretended to hold intercourse with spirits, in which he had credit with Elizabeth and other contemporary sovereigns. Such was the systematic ascendancy of superstition in the age of James I., that Casaubon, one of the most learned men of his time, under the patronage of the King, actually edited, in two volumes, folio, Dr. Dee's Journal of his Conversation with Spirits and Angels. Dee used to see them in a black stone, which is still preserved in the British Museum.

DEFOE, Daniel, author of Robinson Crusoe, and many works, died in 1731.

DELAMBRE, a French astronomer, died in 1819.

DELILLE, a French poet, author of Les Jardins, &c. died in 1803.

DEMOCRITUS, a very profound Greek philosopher, born 460 B. C., and lived above a century.

DEMOSTHENES, was the most admired of Greek orators, and an Athenian patriot, who aroused the Republics against the growing power of Macedon. To save himself from Antipator he took poison, in 322 B. C., in his 59th year.

DESCARTES, Renatus, was a very able French philosopher, born in 1596, and died in 1650, after giving a system of nature, which contained many new discoveries. He taught a plenum of matter; and SPINOZA the divine omnipresence, in that matter which he called *the soul of the world*, a favourite notion of the astrologers.

DE WITT, John and Cornelius, were two Dutch patriots, who, after spending their lives in the service of their country, were, by an Orange mob, torn to pieces, in 1672.

DIDEROT, was a powerful French philosophical writer, who died in 1784.

DIDO, was a Phœnician princess, who, about 869, conducted a colony to Carthage.

DIODORUS Sieulus, was a Roman historian, who lived in the age of Augustus.

DIOGENES Laertius, was a Greek historian of the 2d century.

DIOGENES Apoloniates, ascribes all things to *air*, and he adopted an element between fire and air, apparently the gas or ether of the moderns.

DŒDALUS, was a famous mechanical inventor, who lived under Minos in Crete, and made automata, &c.

DOMINICHINO, painter, died 1641.

DOUW, Gerard, painter, died 1673.

DRAKE, Sir Francis, sailed round the world in 1577-80, and afterwards served as an admiral.

DRYDEN, John, poet, died 1700.

DUCIS, a French dramatist, died 1817.

EDRISSA, was an Arabian geographer, in the 12th century. He described the earth as round, and gave its size as 11,000 leagues, or about 27,000 miles; and stated, that Hermes had made it 36,000, which proves that the ancient Egyptians were familiar with the shape, and approximated the size. He imagined, that south of the equator was a region of fire; and, beyond the 64th degree of north latitude was a region of ice and darkness. The Atlantic he called the sea of darkness; and the Northern Ocean, the sea of pitchy darkness. He described England as a country of perpetual winter, and Scotland as an island.

There were six EDWARDS, Kings of England, of whom the first was the unrelenting conqueror of the Welsh and Scotch. The second was a weak prince, and put to death in 1327. The third made wars on the French Crown, and was chiefly distinguished for his enterprising family. The fourth was great-grandson of the former, and waded to the throne through rivers of blood in the frightful wars of the White and Red Roses. The fifth was murdered in his 13th year, and the sixth died in his 16th year, in 1553.

EDWARD, surnamed the Confessor, was a priest-ridden prince of the dark 11th century. He began the touch for the King's Evil, and was a party in many miracles. His monkish habits forbade a connection with his Queen, and, dying without issue, a doubtful succession made the kingdom a prey to a band of Norman adventurers; he died in 1066, and was the last of the race of princes descended from those barbarous intruders, Hengist and Horsa.

EGBERT, King of Wessex, having had experience in the wars of Charlemagne, on succeeding to the throne conquered the other Saxon kingdoms, and in 827 united England in one kingdom; he died in 838.

EICHHORN, a very learned German writer, died 1827.

ELISHA and ELIJAH, Jewish poets or prophets, flourished about 975.

Queen ELIZABETH, daughter of Anne Boleyn, succeeded Mary in 1558, being then 25. She sustained the Reformation during a troublesome reign of 45 years, in which she yielded herself to successive favourites. The murder of her cousin Mary stamps her as a heartless tyrant; while the execution of her favourite Essex, and her severe laws against the Catholics, rendered her the true child of Henry VIII. She was a woman of talent, if not of feeling, and died in 1602.

EMERSON, W., mathematician, died 1782.

EMPEDOCLES, was a Greek philosopher, who admitted four elements, the principle of whose action was friendship and strife, or the attraction and repulsion of the moderns.

By friendship's aid, we sometimes with one
All things collect; and sometimes strife detains
All things apart, discordant borne along.

And these he makes co-ordinate with the four elements. Again, we have further confirmation in these lines—

And each with equal power is found endued,
When strife pernicious is from each apart,
And friendship equalized in length and breadth.

EPAMINONDAS, a renowned Theban, who gained the victories of Leuctra and Mantinea, was killed 363 B C.

EPICTETUS, a distinguished moral philosopher, flourished 161 A. C.

EPICURUS, the Grecian philosopher, was born in the 100th Olympiad. His was the school of the garden: he died at 72, and his atomic philosophy has in part survived to this time; and, as a moralist, good with him consisted in knowledge and virtue.

ERASMUS, a very eminent scholar and philosopher, was born at Rotterdam in 1467. In 1510, he published his Praise of Folly; in 1516, his Greek and Latin Testament; in 1522, his Colloques; and, in 1535, his Ecclesiastes; he died in 1536, at Basle; his works fill eleven volumes in folio.

ERSKINE, Lord, was the most eloquent lawyer and most benevolent man of his age; born in 1750, Chancellor in 1806, and died in 1823.

EUCLID, was a native of Tyre, and patronized in Egypt by Ptolemy; his collected Elements of Geometry have been translated into all languages, and still are the Bible of Geometry, or of quantity and number. The man who has not read and enjoyed Euclid, has but half a mind. Archimedes and Apollonius, of Pergamus, perfected what Euclid had founded.

Prince EUGENE, was born in 1663. At 26 he became a general, and was commander in all the Austrian wars for 30 years, dying at Vienna in 1736

Leonard EULER, the chief philosopher of the 18th century, was born at Basle in 1707. In 1730, he became professor at Petersburg. In 1741, he removed to Berlin; but, in 1766, returned to Russia, and became blind, dying in 1783. His memory and acquirements were prodigious; his select works are in 18 volumes.

EUSEBIUS, a learned father of the church, was born in Palestine in 270; he was president of the Council of Nice in 325; he was not a Trinitarian, but opposed and condemned Athanasius; he died about 339. There is a Cambridge edition of his works, in 3 vols. folio.

EVELYN, John, naturalist; died 1706.

EYCK, Van, the first painter in oil-colours; born in 1370; and, about 1396, he painted Chaucer, the English poet.

FABII, were a celebrated family at Rome, whose line produced 7 dictators, 7 censors, 48 consuls, 13 triumphs, and 2 ovations.

Lord FAIRFAX, was the Parliamentary General against Charles I.; he commanded at Marston Moor, Naseby, and Colchester; he was reconciled at the Restoration, and died in 1671.

FAUST, was a goldsmith at Mentz, whose success in printing led the copiers to libel him as in league with the devil; he died in 1466.

FERDUSI, the Persian Poet, lived in the 10th and 11th century, and wrote the famous Persian poem, in 60,000 lines, called the Shanameh, or Book of the Kings. It is a series of splendid and unrivalled Epics, detailing events from Nourshrivan to Yezdegerd; its best part is the Episode of Rustan, the Persian Hercules; it was patronized by the Sultan Mahmoud, but not being sufficiently courtly, the poet died in distress and exile.

FENELON, Archbishop of Cambray, author of Telemachus, and celebrated for his eloquence, was born in 1651. In 1688, he was entrusted with the education of the French princes, and, in 1695, made Archbishop; he died in 1715.

James FERGUSON, an ingenious lecturer and writer, was born in 1710, and died, in London, in 1776.

FERMAT, a mathematician of Toulouse, who died in 1665, was the original author of many important discoveries and suggestions, of which subsequent writers have availed themselves.

Henry FIELDING, the novelist, was born in 1707; and, after writing Joseph Andrews, Tom Jones, Amelia, and other works, he died at Lisbon, in 1754.

FINGAL, or FIN MAC COUL, was the father and hero of the Poems of Ossian. He lived about 300 A. C., and was celebrated as a hunter and a hero, according to the Scotch of Selma, near Glencoe, in Morven. His name is not less known in Ireland than Scotland, and doubts are entertained whether he was not an Irish hero, whose dominions included the adjacent coasts of Ireland and Scotland, especially the intervening islands.

Bishop FISHER, a very exemplary character, who, in his 86th year, was put to death by the tyrant Henry, for not acknowledging his supremacy.

Nicholas FLAMMEL, a real or pretended alchemist of the 14th century, who, without known means of acquiring property, expended 2 or 300,000*l.* in building 3 churches and endowing 14 hospitals at Paris, besides conferring revenues on 7 old ones. Such unparalleled wealth—for by profession he was only a miniature-painter—leading to public enquiry, he declared his power of converting mercury into gold or silver, and also of prolonging life; and he and his wife lived to 100. Various French writers confirm this story, and of the churches and hospitals there is no question. This, and other assertions of a like kind, infatuated chemists for 3 or 400 years after; and it is proved, by his own MSS., that our Newton, and Dr. N., an uncle of his, devoted years to re-discover the secrets of Flammel.

FLAMSTEED, John, the first astronomer-royal, died in 1719, aged 73; he was the father of English and of modern astronomy, and, in 40 years, formed a List of the Stars, from actual observation; lately re-edited, from the original notes, by Bailey, who has done merited justice to his character.

FLAXMAN, sculptor, died in 1816.

Andrew FLETCHER, of Saltown, a distinguished Scottish patriot, was born in 1658; he attached himself to Monmouth's army, and escaped to Spain; he was an eloquent member of the Scottish Parliament after the Revolution, and died in London in 1716. His works in favour of civil liberty are valuable.

FLEURY, Cardinal, died 1743.

FONTANELLA, author of Pierre Viand, and other works, died 1812.

FONTAINE, poet, died 1695.

There were two FONTANAS, brothers, and eminent Italian philosophers. Felix, born in 1730, who wrote on poisons and chemistry, and died in 1806; and Gregory, born in 1735, who wrote largely on mathematical philosophy, and died in 1803.

FONTENELLE, philosopher, died 1757, aged 100. There was a fabulist and poet of the same name.

FOOTE, dramatist, died 1777.

There were two FORSTERS, father and son, natives of Dantzic, both of whom passed the greater part of their lives in England, and wrote extensively on natural history. John Reinhold was born in 1729, and died in 1789; he accompanied Capt. Cook's second voyage as a naturalist, and his son published an account of the voyage.

FOURCROY, the eminent French chemist, was born in 1755; to him we are chiefly indebted for the new nomenclature, and for many important discoveries in chemistry; he died in December, 1809.

Charles James FOX, a distinguished English senator, was born in 1749; and becoming M. P. in 1768, he at first voted with the Tory party; but, on quarrelling with Lord North, he opposed the American war till 1782, when he became Secretary of State, and, in 1784, joined Lord North in a new ministry; but, being ejected by the Pitt party, he remained in opposition till 1806, when he was again made Secretary of State, but died in a few months.

FOX, George, a religious enthusiast, died in 1690.

FRANCIS I. was a magnificent king of France, who died in 1547.

There were three saints of the name of FRANCIS;—one called d'Assisi, who died in 1226; the second, de Paulo, who died in 1508; the third, de Sales, who died in 1622.

FRANKLIN, Benjamin, was a very rational philosopher and distinguished American patriot, who promoted the war of independence, and died in 1790, aged 85.

FREDERICK II., of Prussia, was a distinguished modern sovereign, as a successful general in complicated wars; as a philosopher and man of letters; and, as a severe governor of his people. His works are numerous, and he patronized many men of letters; but his merciless imprisonment of Trenck is a stain on his character; he reigned from 1740 to 1786.

FROISSART, was a chronicler from 1324 to 1400.

FULTON, John, was an American engineer, who first practised steam-navigation with success; and, after many other inventions, died, aged 48, in 1815.

GALILEO, the founder of mechanical philosophy, was born at Pisa, in 1564, and there he received a finished education. His first discovery was the use of the pendulum as a measure of time; and, in 1589, he was made University lecturer in mathematics, and soon after adopted the Copernican system. The philosophy of that time, *like the present*, consisted of words intended to mystify its votaries, and Galileo used to call it the *wordy* philosophy, and its teachers *paper* philosophers. About 1591, he invented or improved the thermometer, and, soon after, became professor at Padua. In 1597, he wrote to Kepler, stating that he had made many discoveries which he durst not publish, "*owing to the fools who worshipped previous systems.*" In 1606, he invented the sector; and, in 1607, he repeated and improved the magnetical experiments of Gilbert. In 1609, he tried Baptiste da Porta's idea of combining lenses to see distant objects, a combination which Leonard Digges, an Englishman, had also effected; and he was led to do this by the recent formation of a telescope by some Dutch spectacle-makers. With this he at once discovered Jupiter's Moons, Venus' phases, and the ring of Saturn, and he followed these astonishing discoveries by constructing the microscope. These distinctions brought on him a torrent of abuse and misrepresentations, and, in writing to a friend, he remarks, that "as to advancing in public opinion, or gaining the assent of the *book* philosophers, let us abandon both the hope and desire." He now removed to Florence, and resided in the court of the Grand-Duke with a large pension. In 1611, he discovered, at Rome, the spots in the sun; but all these facts being inconsistent with the Jewish cosmography, the priests began to preach against him, and, in 1615, to the eternal disgrace of the Catholic church, he was arraigned before the inquisition, and, though discharged, they condemned the doctrines of Copernicus, and forbade them to be taught, or the books describing them to be circulated. He now returned to Florence, and wrote his Dialogue on the Ptolomaic and Copernican systems, leaving the readers to decide between the speakers; and published it, with license, in 1632, for which he was again arraigned and tortured; and, at 70, made to abjure publicly on his knees, and to curse his own book and doctrines, and sentenced for the next three years to remain in prison, and repeat once a week the seven penitential psalms. To all this he submitted, to escape the fate of *Bruno*, who, for similar opinions, had been burnt at Rome but 32 years before. His powerful friends, however, enabled him to make their houses his prison for three months, and he was then allowed to live at home, but not to go abroad, or to receive visits. In 1636, he became blind; and, in 1638, he was allowed, on the same conditions, to pass a few months at Florence, and to receive a friend in presence of an officer of the inquisition. His last discoveries were the Moon's librations and the cause, and his last project the determination of the longitude by Jupiter's Moons, to which he united an improvement of time-pieces. In 1636, he finished his dialogues on motion; but, as the inquisition had forbidden every thing under

his name, they were, after much difficulty, printed in Holland. In this work he explained the rectangle of velocity and quantity, or equal momenta, but quoted Aristotle for the principle; and he also developed what are called the laws of motion, of falling bodies, and projectiles, principles rhapsodized by Descartes, and mystified by Newton. After he became quite blind, and very infirm, the inquisition relaxed; he died in 1642, aged 78. Nor was he the mere philosopher, for he wrote the purest Italian, and cultivated the belles-lettres; he used to say, that reading Tasso after Ariosto was like eating cucumbers after melons. He was married, had children, and was a great connoisseur in wines. After his death, being still under sentence, his right to make a will was disputed; he was denied Christian burial; and his MSS. were seized and lost.

GALEN was a physician of Pergamus, and died in 140, aged 70.

GALVANI was an Italian experimentalist, who discovered the mode of exciting electrical action, by opposing bodies of different affinity for oxygen, and first displayed, by accident, in frogs; he died in 1793.

GAMA, Vasco de, was a Portuguese navigator, who first discovered the Cape of Good Hope, in 1497, and established the Portuguese in India.

GARDINER, Bishop, was brought up under Wolsey. He was by Henry VIII. made Bishop of Winchester, and a leading instrument in his murders. In the next reign he was committed to the Tower; but, under Mary, he was made Chancellor and first Minister, directing the fires in Smithfield; he died in November, 1555.

GARRICK, David, was an unrivalled player, and a man of great genius; he died January, 1779.

GASSENDI, Peter, one of the most eminent of the restorers of mechanical philosophy and astronomy, of the school of Galileo, died in 1655, aged 63. He taught that all our ideas are derived from, and compounded of, sensations. Hobbes taught the same; and Locke followed them, superadding *reflection*, or ideas derived from the operation of the understanding, posterior to ideas derived from sensation.

Dr. GAUDON was believed to be the author of the *Icon Basilike*, which he caused to be printed as the production of Charles I.; he died a disappointed Bishop of Worcester, in 1662.

GAY, dramatist and poet, died in 1732.

GENGHIS KHAN was the chief of a tribe of Tartars, called Moguls; in 1210, he was adopted as chief of all the Tartars of Western Asia, and, entering China, took Pekin, and added the northern provinces to his empire. He afterwards overran Persia, and gained a victory over the King of Karisme, in which his army of 700,000 Tartars defeated 400,000 Karismeans, with a loss of 160,000 slain; he died in 1227. His successors overran India, destroyed the Caliphate, and established the great Turkish empire in Asia and Europe.

St. GEORGE, called the patron saint of England, was a profligate fanatic of the fourth century, born in Cilicia, and at first engaged as contractor for the army; but, his peculations being detected, he fled, and, turning Arian, contrived to eject and succeed Athanasius, as bishop of Alexandria, where he committed great atrocities; but, on the accession of Julian, he was finally torn in pieces by the populace. The Arians, on joining the Catholics, got George enrolled, and he was adopted by the English as their patron in the Crusades.

GIBBON, EDWARD, a very able and laborious historian of the Roman empire; he died in 1794.

There were two modern GIFFORDS, both political writers in support of the Court of George III. John, the Editor of the Anti-Jacobin Review, and a police magistrate. William, a poet, Editor of the Quarterly Review, who held also two appointments under government; he died in 1826.

GILBERT, WILLIAM, an experimenter on magnetism, which, agreeably to the then prevailing philosophy of witcncraft, he ascribed to attraction, and all the phenomena to a central magnet in the earth, which he considered an intelligent principle. His elaborate researches paved the way to some speculations of Bacon, and the hypotheses of Newton; he died in 1603.

GLANVIL, JOSEPH, M. A., was one of the first members of the Royal Society, and famous for his illustrations in confirmation of witchcraft, published in 1670.

GLAUBER, chemist, flourished in 1660.

GLENDOWER, OWEN, the last of the heroic patriots of Wales, died in 1415.

GLOVER, RICHARD, poet, died 1785.

GODFREY, King of Jerusalem, one of the martial fanatics in the first crusade. He took Jerusalem in 1099, and won the battle of Ascalon, but died in 1100. He is the hero of Tasso.

GODOLPHIN, made an Earl by Anne, and the head of her Whig Ministry, was an active politician in the reign of Charles II., James, and William; he died in 1712.

GODWIN, Mary Wolstonecraft, an ingenious woman, who wrote a Vindication of the Rights of Woman, and other original works. She died in 1797.

GOLDSMITH, Oliver, poet and dramatist, died 1774.

GORDON, Lord George, son of the Duke of Gordon, who, as the presenter of a petition against Catholic concessions, in 1780, was charged as an instigator of the mob riots, in which not even any of the petitioners were implicated. He was tried and acquitted; but, persecution continuing, he turned Jew, and was imprisoned, from inability to find exorbitant bail, till his death, in 1793.

The GRACCHI, were two brothers, Tiberius and Caius, who advocated the rights of the poor against the usurpations of the nobles, by insisting on the equal distribution of the public lands acquired by conquests. For this Tiberius was murdered by

the Patricians, in 133, and Caius in 121, B. C. The subsequent accumulations in few hands proved ultimately the ruin of liberty.

GRAMMONT, Count de, was a courtier of Louis XIV. and Charles II., celebrated by his Memoirs of the profligate court of England; he died in 1707.

GRAVES, Richard, the colleague of Pope, Shenstone, Melmoth, Allen, Pratt, &c., and author of some elegant works, died 1807, at 92.

GRAY, the author of the Elegy in a Country Church-yard, and other superior poems, died 1771, aged 55.

Lady Jane GRAY, famous for her precocious talents and tragical end. She was daughter of the Duke of Suffolk, and granddaughter of Henry VII. She was married at 16, in 1553, to the fourth son of the aspiring Duke of Northumberland, who got her proclaimed queen in prejudice of Mary, her own father heading an insurrection in her favour. She and her husband were beheaded in Feb. 1554.

GRÆVIUS and GRONONIUS, contemporary editors of Greek and Latin authors, lived in the end of the 17th century. And there were five other Grononiuses, sons and grandsons, in the same career of verbal criticism and emendation; the last, also, a naturalist, and he died in 1777.

Pope GREGORY, called Hildebrand, flourished in the 11th century; he excommunicated the Emperor of Germany, and commenced that arrogant system of ecclesiastical domination which ultimately led to the reformation.

GRESHAM, Sir Thomas, a munificent London merchant, died 1579.

GROTIUS, or Huig-de-Groot, was born at Delft, in 1583; his work Bewijs Van den waren Godsdienst, or De Veritate Religionis Christianæ, was written in Dutch verse for the use of Fishermen and Sailors.

GUIDO, painter, died 1642.

GUILLOTINE, introducer of that merciless instrument, was a French physician, who died in 1814.

GUSTAVUS VASA was King of Sweden from 1523 to 1560; and his grandson, Gustavus Adolphus, from 1611 to 1632, when he was killed in a victory gained over Wallenstein at Lutzen.

GUY, Thomas, a miser, who, dying in 1724, left nearly half a million to various charities and a hospital.

GUYTON MORVEAU, a very distinguished French chemist, and author of many discoveries; he died in 1815.

HAFIZ, a Persian poet of great popularity, died 1389.

HALE, Sir Matthew, a pious judge, who, though a philosopher, yet in that age of superstition, condemned to death some persons accused of witchcraft, so late as 1664; he died in 1676.

HALLEY, Edmond, a very enterprizing mathematical philosopher, who flourished from 1675 to 1742.

HAMPTON, John, a leader in the cause of English liberty, who was killed in a skirmish near Thame, in 1643.

HANDEL, G. F., the prince of musicians, born 1684, and died in London, 1759.

HANNIBAL, a Carthaginian general, who, in 219 B. C., took Saguntum; in 216, gained the great battle of Cannæ; and, in 183, died in exile.

HANWAY, Jonas, a philanthropic merchant, and eastern traveller, who died 1786.

HARRIS, James, a learned philologer and philosopher, died 1780.

HARRISON, John, a very ingenious mechanic, who received the parliamentary reward of 20,000*l.* for a perfect time-keeper. He was born near Pontefract, and died in 1815.

HARVEY, discoverer of the circulation of the blood, born 1578, died 1658.

HARGREAVE, James, an ingenious mechanic of Blackburn, who, about 1765, invented the spinning-jenny; and, subsequently, the other important parts of cotton machinery; he died poor, at Nottingham, in 1778, and left a family, who have lived in great indigence at Manchester.

HASTINGS, Marquess of, a benevolent English statesman, and Governor-General of India from 1812 to 1822; he died 1825.

HAWKESWORTH, Dr., poet and polite writer, died 1773.

HAYDN, F. I., a very eminent musician, died 1809.

HAYLEY, W., poet, died 1820.

HELENA, the mother of Constantine the Great, was a native of Colchester, where some say her father was an inn-keeper, and others a person of high rank; and became pregnant by Constantius Chlorus, the Roman commander, and afterwards associate with Dioclesian. The Greeks, however, allege that she was born at Drupani, in Bythynia, afterwards called Helenopolis; that Constantius stopped at her father's inn, on his embassy to Persia. She lived through the reign of her son, and died in the same year 337, upwards of 80, having, through life, exerted her influence in favour of the Christians. Her grandson Julian, who became Emperor in 360, and who had been educated among the philosophers at Athens, reversed all her plans, re-opening the Heathen temples, and closing the Christian.

HELVETIUS was a very able French metaphysitian, born 1715, and died 1771; he ascribed the differences, in the minds of men and brutes, to bodily conformation and organization; BLUMENBACH, to the different quantities of the medullary substance in the brain. GALL, to the parts of the brain principally developed. CUVIER agrees with Blumenbach and Helvetius.

There have been eight HENRYS, Kings of England. The first, son of the Conqueror; the second, an amiable prince, disturbed by the arrogance of Becket and the priests. The third, a pusillanimous king. The fourth, a usurper. The fifth, his son, who won the battle of Agincourt, in 1415. The sixth, his son, an imbecile, with a dis-

puted throne; but supported by his queen, Margaret. The seventh, a usurper, miser, and tyrant. The eighth, the English Nero, who was restrained while Wolsey reigned; but, released from the dominion of that great man, he disgraced England by his robberies and horrible executions, to gratify his lust.

HEROD the Great, a king of Judea, highly extolled by Josephus, born 71 B. C., and died about two years after the birth of Christ. There were three other Herods, the last of whom died about 94 A. C.

HERODOTUS, the first Greek historian and father of history, according to Cicero, lived about 450; and there is this proof of the credit due to him, that his work was read in public, made known at once to the whole world, and honoured and praised by all. He was contemporary with Pindar, Sophocles, Pericles, Phidias, Euripides, and Hippocrates, an age of perfection in every pursuit.

HERSCHEL, Sir William, was born in Hanover, of Jewish extraction, and educated as a musician; he sought his fortune in England, with other Germans who followed the Guelphs. He settled in the Band at Bath; but, being an inquiring, and very ingenious man, he studied optics and astronomy; and, conceiving the idea that the possessor of the largest telescope would make the greatest discoveries, after years of patient labour, he obtained the patronage of some Germans at Windsor, took a house at Slough, and set up in his garden his famous 40-feet reflector with a power of 6000. The mirror was, however, too heavy to keep its form, though a few astonishing sweeps were taken; and he was obliged to return to 5 and 6 feet achromatics, and small reflectors, all of his construction. His diligence, and that of his sister, soon enabled him to observe a progressive motion in a dull star, that 2 or 3 times had been noted by astronomers; and, finding it to be a planet, he astonished the world by announcing the discovery of the Georgium Sidus, in 1781. This procured him a pension, the favour of the Court, and election into all societies. As a self-taught man, neither afraid of the schools nor restrained by their venerable authorities, he became a diligent investigator of the construction of the stellar systems in space, and with such success, that all we know about the Milky Way, the Nebulæ, the Clusters, the progression of the Sun, &c. &c. are due to him. He was the Aristarchus of his age, with the benefit of the telescope; he died at 84, in 1822; he left a son, whom he carefully educated in the adopted sciences of the schools, and who, in the Southern hemisphere, having increased his father's list of Nebulæ, with a superior instrument revised some positions. In 1838, he was elected P. R. S. in compliment to the self-taught and useful genius of his father.

HESIOD, a Greek poet, of the previous age to Homer.

HEVELIUS, an astronomer of Dantzic, died 1687.

HEYNE, a German critic, died 1814.

HIPPARCHUS, astronomer, flourished in 200.

HIRAM was King of Tyre about 1020 B. C. when Solomon built the Temple.

HOBBES, Thomas, a metaphysical politician of the 17th century, who died in 1679, aged 91. In some of his works he asserts that Ezra wrote the Pentateuch, and that the New Testament was not received as canonical till the Council of Laodicea, in 364.

HOGARTH, an English painter of life and manners, without a rival, died 1764.

HOLCROFT, Tho., dramatist, died 1809.

HOLLAR, engraver, died 1677.

HOLT, Sir John, a very honest English judge, L. C. J. from 1690 to 1709.

HOME, John, author of Douglas, and other dramas, died 1808.

HOMER, the father of poetry, and author of the Iliad and Odyssey, was a native of Chios, or Smyrna, and an illegitimate child, originally named Melesigenes. Becoming blind in Ithaca, he consoled himself with poetry, and became a travelling bard; he died at Ios, and his tomb used to be shewn there. Aristotle says, he was born and died in Chios. Lycurgus first collected his poems. The Parian Marbles state, that he flourished 907 years B. C., or 250 years after the time which he assigns for his legend about Troy.

HORACE flourished 45 B. C.

HOWARD, John, commonly called the Philanthropist, was a Bedfordshire gentleman, who visited prisons throughout Europe, and his enthusiasm created the attention of governments, and led to many alterations; but, being a decided disciplinarian, his alterations were not always ameliorations; his philanthropy led him to visit Turkey, where he died of the plague, in January, 1790; his attentions to the subject led to valuable improvements, but his cruel plan of solitary cells has yielded to public feeling.

HUME, David, a Scotch writer, was born in 1711, and died in 1776; he wrote history and on metaphysics, and rejected or doubted all knowledge not derived from the senses, *i. e.* those ideas derived from reflection, or the operations of the understanding; and, to get rid of the causes invented by Newton, and which he was told were *demonstrated*, he denied the necessary connexion of cause and effect.

There were two celebrated HUNTERS, brothers; one William, who died in 1783; and John, in 1793.

HUSS, John, an heroic reformer, burnt at Constance, July 7, 1415.

There were in the last age three celebrated HUTTONS; James, a speculator in natural philosophy, who died in 1797. William, an industrious antiquary, who died in 1815. And Charles, a very able mathematical philosopher, who died in 1823.

ISAIAH, a Jewish poet, was nearly contemporary with the first Olympiad, 776 B. C.

JANSON, the discoverer of the magnify-

ing power of two lenses, was a spectacle-maker of Middleburg, and made this accidental discovery about 1590. In 1608, he invented the compound microscope.

JEFFERSON, President of the United States, and much distinguished for his wisdom and patriotism, died July 4, 1826, the 50th anniversary of independence; on the same day as the elder Samuel Adams, who, with Hancock, had been exempted from the Royal Amnesty of 1776.

JEPHTHA, a Jewish hero, who sacrificed his own daughter, and contemporary with the taking of Troy, in 1184 B. C.

JOAN of ARC, a country girl, who, in 1429, in conformity with the superstitions of the age, avowed she was commissioned by heaven to drive the English out of France. She was, accordingly, invested with a command, and, raising the siege of Orleans, gained several great advantages, and assisted in crowning the French king at Rheims. Her mission was ended; but she was prevailed on to undertake the defence of Compeigne, and, being taken prisoner, she was, by the execrable Duke of Bedford, Regent of England, burnt as a sorceress at Rouen, in 1431.

King JOHN, the fifth son of Henry II., was born in 1166, and, though his father's favourite, he joined his brothers in rebellion, which broke his father's heart, in 1189; he then rebelled against his brother, Richard I., and kept him prisoner in Austria. On the death of Richard, he made war on his nephew Arthur, and rightful heir to the crown, and, taking him prisoner, murdered him in prison. In 1207, his tyranny led the Pope to put the kingdom under an interdict. All the bishops, &c. left the kingdom, and for seven years no divine service was performed. He now quarrelled with the Barons, lost his dominions in France, and committed an atrocious massacre on his Welsh hostages; he then sought an alliance with the Saracens in Spain, offering to deliver England to them, and turn Mahomedan. At length, in 1213, the Pope appointed Philip of France to remove him; and, on May 13, he resigned his crown and realm to the Pope's Nuncio at Dover, when the inderdict was removed. The Barons now extorted from him Magna Charta, on June 15, 1215; but, to avenge this, he brought over foreign auxiliaries, and got the Pope to annul the charter, and excommunicate the Barons, against whom he commenced hostilities. These invited the French King, and the Dauphin landed at Sandwich, May 30, 1216, with a force brought in 660 ships; he advanced to London, and was well received every where, the nation declaring for him. John, in despair, attacked Lincoln, and fixed his head-quarters at Lynn; whence, crossing the Wash, he lost his baggage and money, and died at Newark, October 19, 1216, of a dysentery.

JOOST, VANDEN VONDEL, born in 1587, is esteemed, in Holland, equal to our Shakspeare; he wrote a poem, called Lucifer, which the Dutch regard as equal to Milton.

JOSEPHUS was a learned Jew, born 37 A. C., and, after a youth of study, became a leader against the Romans; but, being taken prisoner, was received into the favour of Vespasian and Titus, and present at the siege and destruction of Jerusalem; he afterwards lived at Rome, and wrote his various works; he is, by the Jews, called Ben Gozion, and their copy differs considerably from the ordinary translation from the Greek.

There were two JUSSIEUS, uncle and nephew. The former died in 1779, after suggesting the natural system of plants; but it was perfected by his nephew, Antoine Laurent, in 1789, and, with the further aid of De Candolle, is now the prevailing system. The nephew died at 88, in 1836.

KANT, Immanuel, a Prussian logician, and metaphysical systematizer, was born in 1724, and died 1804; he divides philosophy into Physics, Ethics, and Logic. The two former are *material* sciences, which take cognizance of external and internal facts; whereas the latter is purely *formal*, and treats only of the *form* and connexion of our thoughts. Sense is the faculty which receives the matter of all the phenomena of nature; it is therefore *passive*, and has only two modes or forms of receiving. It consists, therefore, of the two receptivities, *time* and *space*. Reason is a faculty that acts quite independently of time and space, by its *six pure activities*, which are the Six Ideas—Absolute Totality; Absolute Limitation; Absolute Substance; Absolute Necessity; Absolute Cause; Absolute Concurrence. His system begins with six axioms:—1. Consciousness, or egotism. 2. Time, the *form* of internal sense. 3. Space, of external sense. 4. Sense, for intuition. 5. Understanding, for conceptions; and 6. Reason, for Ideas. Intuitions are, he says, present in time and space; Conceptions, absent in time and space; Ideas, things out of time and space; and the three generate mind. He then asserts, that TIME and SPACE are in the mind, and are the receptivities of SENSE. UNDERSTANDING, he refers to Aristotle's four categories of quantity, quality, relation, and mode; and their species unity; Many, the whole; Existence, negation, size; Property and Accidents, cause and effect, action and re-action. Possibility, certainty, necessity. Reason, he founds on the categories in their absolute sense, as totality, limitation, substance, cause, concurrence, necessity.

LACEPEDE, Count, a French naturalist, and long President of the Senate under Napoleon; he died of the small-pox, at 69.

LA GRANGE, a very profound mathematician, died 1805.

LANJUINAIS, Count, one of the most enlightened patriots of the French Revolution, which he survived, and died 1827.

LA PLACE, a very profound mathematician, died 1825.

LE SAGE, the author of Gil Blas, was

very deaf; he wrote for profit, and got fame also.

LEAKE, Sir John, a distinguished English admiral, who died 1720.

LEIBNITZ, G. W., a celebrated Saxon philosopher, contemporary of Newton, Locke, and Clarke, and inventor of the Differential Calculus; he was born in 1646, and died in 1716 He taught a *pre-established Harmony*, by which the mind contains general notions and truths, like the plant in the seed; so that, according to him, "every thing goes on in the soul, as if it had no body; and in the body as if it had no soul." *Opticism*, or the doctrine that this is the best of all possible worlds, was an inference from *the pre-established harmony*, which he assumed to be formed by the Deity, and therefore perfect. Another mystical phrase of his was *the sufficient reason*, which merely meant, that nothing happens without a sufficient reason why it should be so, rather than otherwise. And another, *the law of continuity*, meaning that motion is never lost, which, extending to the soul, he maintained that it never ceases to think, even in sleep or in a fit.

Nature, says his disciple HELVETIUS, never proceeds *per saltum*, (never jumps,) and the law of continuity is exactly preserved. The two great principles of Leibnitz were, that it is impossible for a thing to be, and not to be, at the same time; and that nothing is without a sufficient reason why it should be so, rather than otherwise.

LEUCIPPUS, a Greek philosopher, asserted that atoms, the elements of all things, were infinite, and always moved; and that they were of various forms, thereby generating and characterising different bodies in figure, order, and position. Democritus and Metrodorus followed Leucippus; and added, that the full and the void are the first causes of things. Zeno, Leucippus, Democritus, Protagoras, and Epicurus, were the inventors of the Atomic System, in which they ascribed the composition of all bodies to smaller and smaller parts, in various forms, called Atoms, at present the principle of chemistry.

LIVY, historian, flourished 15 B. C.

LOCKE, John, a political and philosophical writer, born in 1632, and educated at Oxford; he was patronised by the Earl of Shaftesbury, and obliged to retire with him to Holland, in 1682, and there he wrote his Essay on the Human Understanding. He returned with the Prince of Orange, and died at Otes, in 1704.

LOUIS XVI., King of France, and the representative of a line of sovereigns, under whom, for several centuries, abuses of government and impolitic privileges had been accumulating, till the embarrassments of the government and people rendered it necessary to call a National Assembly in 1788. But the reforms effected, and the free spirit displayed, led the King and Court, covertly or openly, to play the delicate part of opposing the will of the nation, and the increased intelligence of the age. The Bastile was, in consequence, taken by the populace, in July, 1789. In October, the King and family were brought to Paris. In 1791, he fled towards the frontiers, leaving a proclamation, which disclaimed his own assent to all that had been established. Brought back, he ratified his former acts, but maintained a constant intercourse with the armed emigrants on the frontiers, and assembled a large force in the Tuileries. Here he was attacked, August 10, 1792, and after a frightful slaughter of his adherents and assailants, he surrendered, and was committed to the prison of the Temple. The national convention then decreed a Republic, and his trial. This took place in December, 1792, and, on January 21, 1793, he was guillotined the victim of his birth, education, and royal sense of duty. His queen, the victim of circumstances, was brought to trial, and guillotined in October, the fate of both exciting the warmest sympathy, as victims of public circumstances, and of the *external hostilities* of their order out of France.

LUCRETIUS, poet, flourished 80 B. C.

LUTHER, Martin, the German Reformer, was born in 1483, and died in 1546; he was educated, at the University of Wittemburg, by charity; and became an Augustine Monk, a Professor and Doctor of Divinity. In 1517, he published 95 proportions against indulgencies: and, certain princes favouring him, for the purpose of getting possession of the property of the Church, he was enabled to set at defiance all the power of the Popedom. His life was very turbulent and discontented, constantly occupied by controversies and public contests; but he had zealous and able disciples in Melancton, Bucer, Corvin, Jonas, Adam, and others. He was even more rancorous against dissentients from his own doctrines, than against Popery itself; and extremely superstitious about appearances of the devil, angels, &c. He divides Protestant Christendom with Calvin and Arminius.

Mrs. MACAULEY, who married a brother of the noted Dr. Graham, is celebrated as the author of an excellent History of England; much admired for its independent spirit, and much abused by the Court party. She wrote, also, some Political Pamphlets, and died in 1791.

MACHIAVEL, an Italian writer and statesman, was born in 1461; he wrote some works of history, and a treatise on government, called the Prince; a book containing such infamous doctrines, that it is disputed whether it was serious or ironical; he died in poverty, in 1527.

James MACPHERSON, Editor of Ossian, was born at Inverness, in 1738. In 1758, he published his first fragments of ancient poetry, collected in the Highlands. In 1762, he produced *Fingal;* and, in 1763, *Zemora* and others; he died in 1796

MAHMOOD, the first Sultan, was Sovereign of Kandahar, and resided at Ghizni, about the year 1000. He conquered Bactria, and made nine expeditions to India, in

which he took its chief cities, introduced Mahomedanism in place of the Brahmist religion, and carried away immense treasures; he died at Ghizni, in 1028; his son, Musaood, afterwards made three invasions of India.

MAHOMMED was born Nov. 10, 570, at Mecca, and died June 8, 632. at Medina, 23 years after his public mission, and 10 after the recognition, through Arabia and Persia. He was of middle size, dark complexion, lively black eyes, aqueline nose, full cheeks, and regular features; his hair was black, and his beard bushy; his head was large, and he was stoutly built; his voice was fine, and his ear acute; he was just, merciful, and impartial—zealously devoted to the poor, and noble, polished, and affable in his manners; he milked his own goats, and mended his dress and sandals; he lived chiefly on barley bread, and his family on dates and water. At 50, he lost his first wife, Khadijah, and then took several, but Aichah was his favourite.

Madame DE MAINTENON was born in 1635, and married Scarron, an ingenious poet, who died in 1660, and left her in indigence. In repeated petitions to Louis XIV. for a pension, she drew his attention, and obtained an appointment in the Royal nursery—becoming a favourite of the king, who ultimately married her. She survived him, and died in 1719.

MANDEVILLE, celebrated as the author of the *Fable of the Bees*, published in 1723; he wrote other works, and died in 1733.

MANICHÆUS, the founder of an early Christian sect, and a Persian by birth; he wrote a gospel, but attacking the Persian religion, he was crucified, or flayed alive, about the year 277.

Mrs. MANLEY, an ingenious female writer, was born about 1660, and wrote the new Atalantis; two tragedies, called the Royal Mistress, and Lucias; and the comedy of the Jealous Lover, besides other works. She died in 1724.

Lord Chief Justice MANSFIELD, whose first name was William Murray, was born in 1705. In 1742, he became Solicitor-General; and, in 1756, was made Chief Justice of the King's Bench, an office which he filled for 32 years, and died in 1793.

MARAT, a French demagogue, was born in 1744, of Protestant parents, and educated in Medicine; he published various works on Natural Philosophy, in which he displayed considerable talents; but the abuses in the government, and the growing strength of an opposing party, rendered him a politician, and he published a cheap journal, called the *Friend of the People*, which became an authority with the republican party; he was also the leader in the club of the Feuillans, and very active in the commotions of 1792. The Moderés denounced and prosecuted him; and, in July 1793, he was stabbled by Charlotte Corday.

Carlo MARATTI, a distinguished Italian painter, was born in 1625, and died at Rome, in 1713.

MARIE ANTOINETTE, Queen of Louis XVI., was a daughter of the Emperor of Austria, and married in her 15th year. She was beautiful, and possessed the best feminine qualities, but extravagant and dissipated; and, therefore, became the butt of public discontent. In October, 1789, she and her husband were brought from Versailles to Paris, where their plots to emancipate themselves led to the catastrophe of August 10, 1792, on which the Royal Family were closely imprisoned in the Temple. Here her submission to the violent temper of her husband, and her general amiable conduct, belied public report; but she fell a victim to prejudice, in October 1793, nine months after her husband had suffered a similar fate.

MARIUS was a distinguished Roman. In 108 B. C. he defeated Jugurtha, King of Numidia; and, soon after, conducted some bloody wars in Gaul; he was then six times Consul; but, being thwarted by Sylla, he fled to Africa; and, returning, committed unparalleled legal murders on the friends of Sylla, and died 86 B. C.

MARMONTEL, an elegant French writer, was born in 1723; and, becoming the popular Editor of the *Mercure de France*, he acquired great celebrity by his writings in that work, and by his exquisite moral tales; he died in 1799.

There were three MARK ANTONYS. The first, a patriot, was murdered by Marius. The second held great power. And the third killed himself in Egypt, in 30 B. C.

Benjamin MARTIN, an industrious and ingenious writer, was born in 1704; and, at first, a travelling lecturer on natural philosophy, and, afterwards, an optician in Fleet-street. The absurdity of the bankrupt laws led him, in 1782, being then 78, to commit suicide.

Andrew MARVEL was a patriotic English senator, born in 1620, and educated at Cambridge; he was employed by Cromwell, and as an assistant to Milton. In 1660, he became M. P. for Hull, and, till his death, in 1678, was an incorruptible M. P.

MARY, Queen of Scots, was daughter of James V., and of a French Princess. Her father dying a few days after she was born, her mother sent her to France for education; and, at 15, she was married to the Dauphin, who, becoming King, died in six months, when she returned to Scotland, a widow of 18. Here she married the handsome Lord Darnley, a weak profligate, who murdered Rizzio, and was himself destroyed in 1567. Soon after she married Bothwell, suspected of the death of Darnley, which drove the people to rebellion, and Bothwell fled to Denmark, and Mary to England, where her cousin Elizabeth kept her in confinement for 18 years; and then, on the most paltry pretence, and with true Court morality, caused her to be beheaded in 1587, at the age of 38. She was a very accomplished woman, and her story, taken altogether, is most affecting. She was the victim of her own education, of the ambition

of others, of the dirty jealousy of Elizabeth, and of the contests between the Romish and Protestant church interest.

Mrs. MASHAM was the intriguing favourite of Queen Anne, and supplanted the Duchess of Marlborough. Being connected with the Tories, she produced a change in the government. In return, her husband was ennobled; but the family is now extinct.

MASSENA was the most distinguished of Napoleon's marshals, and called by him "the Darling of Victory." He was created Prince of Essling, for his services in that great victory in 1809; and, fond of money, he died immensely rich, in 1817.

MASSILLON, a celebrated oratorical preacher, who flourished in the early part of the 18th century, and died in 1742; his works are remarkable for the splendour of their eloquence.

MASSINGER, an English dramatic writer, was born in 1585, and contemporary with Shakspeare, whose writings he imitated; he died in 1639.

MAUPERTUIS, a French philosopher, was born in 1698. He measured a degree of latitude in Lapland; and, after otherwise distinguishing himself, died in 1759.

Thomas MAURICE, a modern poet of eminence, was born about 1750; and educated in Christ's Hospital and Oxford. Besides his poetical productions, he wrote some works on oriental history and theology, and died in 1824.

MAYOW, John, was an English physician, who was educated at Oxford, and died in his 34th year, after publishing some chemical works, in which he developed many of the principles claimed as discoveries a century after.

Cardinal MAZARIN, a political churchman, born in 1602, who succeeded Cardinal Richelieu as minister to the Court of France; the government of which, he conducted with questionable wisdom, till his death, in 1661.

Dr. MEAD, a literary physician, born 1673, who flourished in London till 1754.

De MEDICI was the name of an Italian family, whose fame will for ever be connected with commerce, the arts, and literature. The founder was John, a merchant of Florence, who died in 1428. After accumulating immense wealth, his son Cosmo, being contemned by the Florentine aristocracy, removed to Venice, but was speedily invited back, and became the patron of every thing which adorns the human character; he died in 1464. His grandson was Lorenzo, whose liberality procured him the name of the Magnificent. He first established academies and a public library; and, by his moral influence, became the virtual sovereign of Florence. He died in 1492, aged 44. The last of the Medici died in 1739.

MELANCTHON, an associate of Luther, and learned reformer, who made converts by the variety of his learning and writings, though it is to be lamented that Calvin quoted his sanction for the unpardonable crime of burning the Unitarian philosopher Servetus. He died at Wittemburgh, in 1560.

William MELMOTH, a tasteful writer of the English language, and an elegant translator, was born in 1740, and died in 1799; his father was the author of a popular tract, called the Great Importance of a Religious Life.

MENAGE, a writer in polite literature, much esteemed in France; he was born in 1613, and died in 1692.

MENDELSOHN, a learned modern Jew, born in Anhalt, in 1729; he was intimately connected with the German literati, and wrote some valuable works of a Metaphysico Moral Character. He died in 1785.

MENSCHIKOFF, Prince, a strolling pie-man, who, by the caprice of despotism, became prime-minister of Russia in three reigns, and then, for the crime of seeking to marry his daughter to the Czar Peter II., was banished with his family to Beresov, 420 miles north of Tobolsk, with an allowance of ten rubles per day. Here he built a church with his own hands, and died a devotee in two years, in 1729. His confiscated jewels were worth half a million, and his estates had 100,000 serfs.

METASTASIO, an Italian dramatist, born in 1682. He was at first a strolling boy poet; and, at 14, he wrote a tragedy. His subsequent works were very numerous; among which were 26 operas, 8 oratorios, and an immense variety of lyric compositions. He died in 1782.

MEYER was an extraordinary proficient in mathematics and astronomy, for whose lunar tables, the English government paid 3000*l*. He was a professor at Gottingen, and died in his 39th year, in 1762.

Dr. Conyers MIDDLETON, an eloquent English writer, was born in 1683, and educated at Cambridge. His chief works are, his Letter from Rome, his Life of Cicero, and his Free Enquiry. He also wrote a number of Controversial Pieces, which are the best models of English style and composition. He died in 1750.

MIERIS, a Dutch painter of the first eminence, born in 1635, and died 1708.

Joseph MILLAR, commonly called Joe Millar, was born in 1684, and was a favourite low comedian; he died in 1738. His Jest-book was compiled by one Motley, and his name prefixed simply because he was a favourite with the populace.

John MILTON, author of Paradise Lost, was born in Bread-street, London, in 1608, and educated at Cambridge; he afterwards resided at Horton, and there wrote his best smaller pieces. In 1638, he made the tour of Europe; and, on his return, opened an academy in Aldersgate-street, and wrote some of his political works, in a decided republican spirit. He defended the trial and execution of Charles, and replied to the Icon Basilike; and also to the work of Salmatius, which he published in 1651, and received 1000*l*. from Cromwell. His exertions brought on incurable blindness. At the

Restoration, he was obliged to conceal himself, his books being ordered to be burnt. In his retreat, he re-commenced and finished his Paradise Lost, and it was printed in 1667. In 1670, his Paradise Regained appeared, and his Sampson Agonistes. He died in November, 1674.

General MIRANDA, a man of extraordinary endowments, and a native of Peru. In 1806, he sailed with an expedition from the United States, to revolutionize South America, and made some progress; but, in 1811, was taken prisoner, sent in chains to Cadiz, and treated with such cruelty that he died.

MIRABEAU, an eloquent French orator, was born in 1749, and a member of the National Assembly in 1789. He was distinguished for his eloquence and patriotism; but died in April, 1791, in the midst of his career.

MOLIERE, a very eminent French dramatist, born in 1620, and died 1673.

George MONK, Duke of Albemarle, was born in 1608. In the civil wars he sided with the King, but was employed by Cromwell; and, at his death, he betrayed his son and his party, and influenced the army to declare for the Restoration, for which he was raised to the highest dignities by Charles II. He was both general and admiral, commanding the English fleets, which fought the Dutch in both wars. He died in 1670.

Charles MONTAGU, Earl of Halifax, a man of talents, and prime-minister to King William, who, on the suggestion of Bishop Burnet, commenced the ruinous Funding System; he was not employed by Queen Anne, but distinguished by George I., and died in 1715.

Lady Mary Wortley MONTAGU, an English woman of extraordinary talents, was daughter of the Duke of Kingston, and born in 1690. In 1712, she married Mr. Wortley, who, in 1716, went ambassador to Turkey; here she wrote her celebrated Letters. In 1718, they returned to England, and Lady Mary figured in the fashionable world till 1739, when she retired for her health to Italy, and wrote other published letters. In 1761, she returned to England, and died in 1762.

MONTAIGNE, a pleasing French writer, was born in 1533, and died 1592.

MONTECUCULI, a celebrated Italian general, was born in 1608; and, after commanding in numerous wars, with pre-eminent distinction, died in 1680.

MONTEZUMA was emperor of Mexico, in 1519, when it was invaded by the Spanish banditti under Cortez; who, after committing great atrocities, imprisoned Montezuma, and in an attack on the Spaniards by the Mexicans, the unfortunate emperor was killed by a stone, in 1520.

Sir Thomas MORE, an able chancellor to the bloody tyrant Henry VIII., was born in 1480, and being patronized by Wolsey in 1530, he succeeded him; but, being a bigotted catholic, he refused to take the oath of supremacy, and, after a long imprisonment was beheaded, in July, 1535.

MOREAU, a French revolutionary general, was born in 1763, and, in 1794, commanded armies in Flanders, and on the Rhine. In 1813, he joined the Allied Sovereigns in the war against France; but, on making his first observation, was killed by a cannon-ball before Dresden.

MOROSINI, a famous Venetian general in their wars with the Turks, died in 1693

MOSES, a priest of Osiris, whose name was Osarsiph, and who headed the Jews on their expulsion from Egypt about 1850 B. C. by Thuthmosis; and of whom we have such full particulars in the books ascribed to him, and sanctioned by the voice of ages. His laws and institutions are excellent, and greatly to be preferred to the theories of political economy which disgrace this age. His principle of perpetual inheritance, and his securities for the poor, merit universal imitation. If he adopted his codes from the eight books of Taautus, and Leviticus exists in Sanscrit, as is alledged, we may presume that Taautus was not original, and that the East has been the fountain at which all the philosophers of the West have drank. The Jews refer to Ezra, the final arrangement of his five books; but the Samaritan must be older than Ezra, as well as the copies found among the Jews in India. The name of the Pharoah being Thuth*mosis*, his Jewish name *Moses* appears, in some way, to be derived from it.

MOZART, the eminent composer, born in 1756, was a prodigy in music from his childhood. After astonishing and delighting the world by a great variety of matchless works, he died in 1792.

MURILLO, an eminent Spanish painter, was born in 1613, and died in 1635, by a fall from a scaffold while he was painting.

Arthur MURPHY, a successful English dramatic writer, was born in 1727; he wrote the Grecian Daughter, the Orphan of China, and other pieces, besides translating Tacitus, and died in 1805.

Joachim MURAT, one of Napoleon's marshals, was born in 1771. In 1800, he commanded the cavalry at Marengo; and, in 1806-7, at Jena, Eylau, and Friedland; in 1808, he was made King of Naples; and, in the Russian expedition, commanded the cavalry; but, on the misfortunes of his patron, in 1815, he was ejected from Naples, and returning again, was seized on landing, and shot October 13, 1815.

There were two MYRDDINS, or MERLINS; one the minister and architect of Ambrosius, who succeeded Vortigern, and built Stonehenge, called Myrddin Ambrosius, and whose skill in bringing the stones from Ireland obtained him the name of Enchanter; and Myrddin, or Morvryn, a British poet and prophet, contemporary with Taliesin, who lived in the following century, and died in Bardsey.

NADIR, Shah, was an usurper of the throne of Persia, born in 1686. Being in-

trusted with the command of an army, by Thamas, king of Persia, on being ordered to disband it, he seized the Shah, and proclaimed himself regent, and, in 1738, king. In 1734, he marched into India, took Delhi, and massacred 100,000 of the inhabitants, robbing the country of 100 millions sterling; but, in 1747, he was assassinated in his tent, after committing frightful enormities of all kinds.

Lord NAPIER, of Merchiston, suggested the logarithmic principle of corresponding series; but we are indebted to Henry Briggs, Gresham professor of geometry, for the tables of logarithms as they now exist, and also for those of sines and tangents. Briggs computed them to 14 plans of decimals, and published them in 1624. He also passed through the astonishing labour of computing natural sines to 15 plans, and the 100th of a degree! Gellibrand and Vlaco perfected them after Briggs' death.

NAPOLEON, emperor of the French, &c., and a man of the most singular fortunes; he was born in Corsica, in 1769, and was educated in the military school of France. Obtaining rapid promotions under the revolutionary government, he was, in 1795, appointed to the command of an ill-provided army, on the Italian frontiers; but, by his vigour and genius, he defeated the numerous armies of Austria, overran Italy, and, in 1797, forced the Italian states and Austria to make peace. He afterwards embarked with his army for Egypt, and overran that country and great part of Syria; but the abuses in the French government led him to return to France, and, in a few weeks, he overturned the government, and, as first consul, placed himself at its head. In 1800, he crossed the Alps, and defeated the Austrians at Marengo; and, in 1801, sought peace with all the Courts which had made war on France. In 1803, some new confederacies of ancient governments were formed against him; but, penetrating into the countries of his enemies, he gained, in the following ten years, a series of unparalleled triumphs at Ulm, Wagram, Jena, Friedland, Austerlitz, &c., becoming, in effect, dictator of the European continent, and following his victories by seeking treaties of peace, which the implacable hatred of the old governments always abused. In 1812, he advanced to Moscow, and his return being intercepted by an early winter and treacheries, his army perished in frost and snow; and, Europe being raised against him, he was defeated at Dresden, and France was invaded on all sides. Paris was surrendered by treachery, and he was obliged, under treaty, to retire to Elba, in 1813. But the treaty not being respected, and it being formally proposed in the congress at Vienna, to seize him, and send him to St. Helena, he anticipated the base design, by landing in France with only 800 men, with only a few of whom he advanced to Paris, and was received by the entire French nation with unbounded enthusiasm, in March, 1815. The congress of the ancient governments now proclaimed him out of the law of nations, and armies were advanced to the French frontiers. In June, he defeated the Prussians and the English, separately; but, at Waterloo, on the 18th, after a desperate battle with an allied army, under the Duke of Wellington, the Prussians, under Blucher and Bulow, were permitted, by the treachery of one of his generals, to attack his right flank and rear, and the French army was in consequence, dispersed. Napoleon then returned to Paris, and, being unsupported, or betrayed by certain public men, he determined to retreat to America; but, on going to Rochfort, and finding it blockaded by English cruisers, he surrendered himself to *the liberality* of the Prince-Regent of England. The British government now executed the original plan, and sent him to St. Helena, placing him under a partizan of the name of *Lowe*. Here he died in 1821, of a cancer in his stomach. His remains were deposited, with all due honours, in a spot of the island selected by himself; but were removed in the year 1840 to France, with the consent of the British Government, and re-interred, on the 16th December in that year, with the greatest military and imperial pomp, in the Hôpital des Invalides, at Paris.

Beau NASH was an eccentric but clever master of the ceremonies at Bath, in the reign of George II.

James NAYLER was a Quaker, who, at first, was a parliament soldier, and afterwards believed he was inspired; and, in this character, in 1657, he entered Bristol on an ass, as a second Christ. For this he was convicted of blasphemy, and sentenced to be several times whipped, branded, his tongue bored with a hot iron, to be imprisoned, and kept to hard labour. He died at liberty, in 1660.

NEARCHUS was an admiral of Alexander the Great, who conducted a fleet from the Persian Gulf, round Africa, to Greece.

NECKER, a French minister in 1788 and 9, was a Genevese, and distinguished for his knowledge in finance. He was no courtier, and his dismissal from office was the immediate cause of the destruction of the Bastile. He retired to Switzerland, and died in 1804.

Admiral Lord NELSON was born in 1758, and, in 1779, made post-captain. In 1793, he served under Lord Hood, at Toulon, &c.; in 1797, under Lord St. Vincent, in the battle of that name; in 1798, he gained the victory of Aboukir, in 1801, he attacked Copenhagen; and, in October, 1805, he was killed in the famous victory of Trafalgar.

Sir Isaac NEWTON was born at Woolstrope, near Grantham, in 1642, and educated at Cambridge, where, in 1669, he became professor of mathematics. In 1672, he published his theory of light; in 1676, his method of fluxions; and, in 1687, his Principiæ, or mathematical system of physics. In 1699, he was made Master of the Mint. He was patronized by Lord Halifax, and by the Princess Caroline; and at his death, in March, 1726, had a public funeral in West-

minster-Abbey. He wrote 400 unpublished MS. sheets, chiefly on theological subjects, and also published on the prophecies of Daniel and St. John; likewise a work on chronology. He was many years president of the Royal Society. In the discussions about *Newton's* jealous temper, and *Flamsteed's* opposition to a Court favourite, a very early letter of Newton's to Flamsteed, published by the Editor, in 1796, is overlooked. Flamsteed had praised Newton in some publication, for which Newton reproves him, and "begs he will not name him in future, since a man may be quoted too often." Can we wonder, after so gross an insult, that Flamsteed was not his flatterer about that gratuitous hypothesis of Universal Gravitation, derived from a vulgar case, whose local cause was not understood, and which, understood, negatives the whole theory. Newton was flattered into his publication by Halley; and, hence, their mutual partisanship. Flamsteed was a patient worker, Newton only a theorist.

Marshal NEY, the bravest of Napoleon's marshals, was born in 1769. He assisted in the various French victories; at Hohenlinden, in 1800; at Elchingen, at Friedland, and at Moskwa; but fell a sacrifice to the changes of government, in 1815, and was shot in December of that year, while the Duke of Wellington commanded in Paris, under a treaty which assured amnesty to all.

NOAH, son of Lamech, and brother of Jubal, Jabal, and Tubal Cain, the fathers of the arts; but, as Noah only was saved in the Ark, his younger brothers must have perished in the flood.

Lord NORTH, prime-minister of England from 1773 till 1782, was born in 1732, and died Earl of Guildford, in 1792.

NOSTRADAMUS was a noted astrologer and prophetical impostor, much honoured in France in the 16th century.

NIZAM, Ul Mulk, was Vizier to the Sultan Alp Arslan, and to his son, and was the model of a good statesman, as well as author of some interesting books. He was stabbed in his 90th year.

Titus OATES was a tool of parties in the infamous reign of Charles II., and became an informer, by whose false accusations several eminent persons were executed, for which he got a pension of 1,200*l.* per annum, and other distinctions; but, in 1686, his perjuries were detected, and he was whipped from Aldgate to Newgate, and from Newgate to Tyburn; but, at the revolution, he was regarded as a martyr, and recovered his pension.

OCELLUS, Lucanus, a Greek philosopher of the fifth century, B. C. His book on the Universe is still extant.

Sir John OLDCASTLE, afterwards Lord Cobham, favoured Wickliffe, for which the clergy prosecuted him by false accusations, and at length caused him to be burnt alive.

OMAR, the second Caliph, ate barley-bread, or dates, and drank water, and his robe was worn in several places. He kindled his own fire, milked the ewes, and mended his shoes and garments. He fed multitudes, and lavished gifts on his adherents. He allowed Abbas, Mahomet's uncle, 25,000 pieces of silver per annum; 5000 to those who fought in the battle of Beder, and 3000 to the last of Mahomet's personal followers: in his reign of ten years, he or his generals captured 36,000 cities or castles, demolished 4000 churches and temples, and built 1400 mosques.

ORIGEN was a father of the church, born in 185, and died in 254, at Tyre; his works make 4 vols. folio.

ORLEANS has given the title of duke to several men, eminent in French history. The first figured in the reigns of Louis XIII. and XIV. The second, his son, married the sister of Charles II., and died in 1701. The third was Regent, in the minority of Louis XV., and a man of taste, who died in 1723. The fourth was a religieuse, and died in 1752; his grandson was Philip, who directed his fortunes to the reformation of the Court, and fell a sacrifice to the fury of factions in 1793. As an assurance of his attachment to the republican cause, he took the name of *Egalité*, and voted for the death of Louis XVI.; his son, Louis Philippe, became King in July, 1830.

ORPHEUS, a genius of the heroic ages, who wrote poetry, and improved music.

OSSIAN, an Irish poet, was son of Fingal, a Gaelic chief. His poems are recited traditionally by the Highland and Irish peasantry, and were collected and revised by Macpherson, in 1762.—Of their antiquity, there can be no reasonable doubt, and proofs are afforded throughout Ireland, and the western parts of Scotland. The name of Ossian also occurs in the contemporary writings of the Welsh bards.

There were two OSTADES, Dutch painters, and brothers; and the works of the elder, Adrian, sell for a great price. He died in 1685.

OSWALD, John, a Scottish gentleman, who, having resided among the Brahmins, wrote a very interesting tract, called the *Cry of Nature*, and some other works. His zeal in the cause of the Frence republic led him to accept a commission as colonel, and he and his two sons were killed in a battle in La Vendée.

OSYMONDYAS was a king of Egypt, who reigned 3000 years B. C.; he is supposed to have been the same as Memnon; and to him is ascribed many of the colossal structures in Egypt.

OTWAY, author of the Orphan, Venice Preserved, &c., was born in 1651, and died, neglected and miserable, in 1685.

OVID, a vivacious Latin poet, who flourished in the Christian era, and died A. D. 17, in banishment.

Thomas PAINE, a political writer during the American Revolution, wrote Common Sense, and other tracts.—Afterwards, in his native country, he wrote the Rights of Man, and other pamphlets. Being elected into the French Convention, in 1792, he wrote,

at Paris, his Age of Reason, against the credibility of the Old and New Testament. He died at the age of 74, in New York.

PAISIELLO, a celebrated musician, born in 1741, and died in 1816.

Archdeacon PALEY, a tasteful and industrious English writer, was born in 1743, and died in 1805, having produced Elements of Moral and Political Philosophy, a work on Natural Theology, &c. &c.

PALLADIO, a classical Italian architect, was born in 1518, and died in 1580, having published some very considerable works on Architecture.

PANCKOUCKE, a Paris bookseller, who died in 1798, was proprietor of the *Mercure de France*, the most extensively-circulated periodical work ever printed. He then established the *Moniteur*, which, above 40 years, has been the official paper of the French government; and he commenced the publication of the famous *Encyclopédie Methodique*, the most extensive and able work of the kind.

PANTHERA, the name of the Roman soldier whom Celsus, and certain Roman and Jewish writers, assert was the father of Jesus, after Mary's separation from her husband.

General PAOLI was a patriot Corsican. He defended his country against the oppressions of the Genoese, who, being baffled, made over their claims to the French government, against whom he also defended Corsica; but being overpowered, he and his friends fled to England, in 1769, and died in London, in 1807.

PAPIN, inventor of the digestor, and author of some works on natural philosophy, was born in France, and died in Germany, in 1694; he was the first who made experiments on the power of steam.

PARACELSUS, an eminent philosopher in a superstitious age; he was born in 1493. He settled at Basle, and pretended to have intercourse with spirits, and to possess the philosopher's stone, and elixir of life; he died in his 48th year, leaving works which make 11 vols. quarto.

PARKINSON, author of the Herbal, was born in 1567, and died in 1640.

Archbishop PARKER, in the reign of Elizabeth, deserves to be memorable for the care with which he preserved the libraries and manuscripts of the religious houses at the Reformation, of which Benet College enjoys the advantage; he was born in 1504, and died in 1576.

PARMEGIANO, a famous painter, was born at Parma, in 1503; his works are of the first order of merit.

Dr. Samuel PARR was born in 1747, and was distinguished by his Greek learning, and his liberal and patriotic opinions; he died in 1825.

Thomas PARR was a remarkable instance of longevity; at the age of 100, he was charged with bastardy; and, at 120, he married a widow. He died at 152 years and 9 months, in 1635, and his grandson lived to be 120. Henry Jenkins, a Yorkshireman, lived to be 169, and the Countess of Desmond to 142.

PASCAL, a very erudite French philosopher, born in 1623. Before he was 30, he made many important discoveries, but he was fanatical on religious subjects; his provincial letters are specimens of acute logic and refined wit. Soon after he became hypochondriacal, and composed "his thoughts." He died in 1662.

St. PATRICK, in the 5th century, introduced Christianity into Ireland, and died March 17, 493.

Father PAUL, a man whose name figured in the 16th century, was born at Venice, in 1552. He wrote the History of the Council of Trent, and some philosophical works, in which he anticipated Harvey's doctrine of the circulation of the blood; he died in 1622.

The two PENNS made a considerable figure in the 17th century. Sir William, the father, was an admiral, who was sent by Cromwell to take Hispaniola, but failing, he made himself master of Jamaica. His son, born in 1644, was educated at Oxford, and, joining the non-conformists, his father sent him abroad; but, in 1666, he came home, and, falling among the Quakers, he embraced their tenets; and his father, in 1668, got him committed to the Tower for preaching against the Established Church. His maxim was, *No cross, no crown*; and he began to preach in the streets, for which he and his companion, William Mead, were prosecuted and imprisoned. His father dying soon after, and large debts being due to him from the Crown, Penn accepted, in lieu of these, the grant of a tract of land south of New York. In 1681, he sailed with a band of Quakers to colonize it. On landing, he entered into a treaty with the Indians, and laid the foundation of Philadelphia, calling the country Pennsylvania. He abolished slavery, and established an excellent code of laws; he died in 1718, in Berkshire.

Thomas PENNANT, a man of fortune, and an industrious writer, was born in 1726, and educated at Oxford; he published, on every branch of Natural History, many valuable works, and also some tours and topographies; he died in 1798.

Spencer PERCIVAL, an English prime-minister, who being employed, in 1806, as counsellor to the Princess of Wales, became possessed of facts so interesting to George III., that, to prevent his publishing them, the King yielded to his terms, turned out the administration, and put Percival and his friends in their places; he was shot by Bellingham, in 1812.

PERICLES, an Athenian, was born about the year 500 B. C., and his eloquence soon gave him popular influence; he married the famous Aspasia. By his public spirit and his talents, he ruled Athens as a sovereign, without the name, and purchased the public homage, by building the Parthenon and Odeum, and by patronizing Phidias and others; he died 429.

The four brothers PERRAULT were a

remarkable instance of quadruple genius in one family; Claude, the elder, born in 1613, built the Louvre. Charles II. held important situations under Colbert, and wrote many valuable works. Peter and Nicholas also wrote books of reputation.

PETER the Great, Czar of Muscovy, was born in 1672. In 1697, he made the tour of Europe, and at Sardam, in Holland, wrought as a shipwright, sending to Russia, from that country and England, the best artizans he could procure. In 1709, he totally defeated Charles XII. at Pultowa, and, in that war, obtained possession of those provinces of which Petersburg is the centre. In 1716, he made another tour; and, in 1723, he made war on Persia, and acquired some provinces. In 1725, he died, being succeeded by his widow, Catherine I., who had lived in the capacity of menial servant in Prussia, and had been taken prisoner by the Russian army.

PETRARCH, Francis, was born in 1306, in Tuscany. At 27, he fell in love with Laura Sade, at Avignon, and this incident tinged his whole life. She was, however, engaged or married, but he settled near her at Vaucluse; and here he wrote his sonnets to Laura, and different works, which raised him to a pinnacle of cotemporary fame. In 1348, Laura died of a plague, which then prevailed throughout Europe. Petrarch lived till July, 1374.

Sir William PETTY was the son of a clothier at Rumsey, and born in 1623. In 1649, he graduated as a physician, at Oxford. He was one of the first Fellows of the Royal Society, and one of the first writers on political economy; he died in 1687.

PHIDIAS, the celebrated Athenian sculptor, who enjoyed the advantage of being patronized by Pericles; he carved two statues in ivory, 90 feet high; and the best ancient works are ascribed to him.

PHILIBERT, Prince of Orange, commanded the imperial army at the taking of Rome, for Charles V., in 1527; he was killed in 1530. William, his cousin, succeeded him, and was elected head of the Dutch, in their resistance to Spain, under Philip II.; he was assassinated in 1584. Maurice, his son, established the independence of the Dutch States, and usurped the government, but died in 1625; his grandson was our William III.

PHILO Judeus, a learned Jew, flourished about the time of the Christian Era, and wrote various learned works and commentaries.

PICHEGRU, a French revolutionary general, was born in 1761. In 1794, he had the command of the army of the North, defeated the Duke of York, and the Duke of Saxe Coburg; and, pursuing them across the Rhine, over-ran Holland, and entered Amsterdam, in January 1795. But, in September, 1797, he and 65 deputies, and two directors, were transported to Cayenne, but making his escape, he emigrated. In 1804, he returned, but was arrested, and, in a few days, found dead in his prison.

PICUS, Mirandola, a miracle of learning in the 15th century, was familiar with twenty-two languages, and master of all the science of his time; he visited Universities, to challenge professors, but died at Florence, in 1496, aged 33.

PILPAY, an oriental philosopher, wrote his apologues about 2000 B. C.

PINDAR, the Greek lyric poet, flourished about 500 B. C.

William PITT, Earl of Chatham, was born in 1708. In 1735, he became M. P., and joined the party of Frederick, Prince of Wales. In 1744, the Duchess of Marlborough left him 10,000*l*., and, in 1746, he became a placeman; and, according to the vacillation of parties, was in and out of office till 1768. In 1778 he died, in consequence of his exhaustion during a speech which he made in the House of Lords, against the American war. His second son was the equally-celebrated William Pitt, who was born May 28, 1759; he was educated at Cambridge and Rheims, and, in 1780, became M. P., taking the side of the Reformers. In 1782, he was made Chancellor of the Exchequer, and, in 1783, in his 24th year, became Prime-Minister; a station which he retained, in spite of the shocks of parties, till 1801, and then resigned. In 1804, he became Minister again, but died in January, 1806.

PIUS VI., the last Pope but two, succeeded Clement XIV., in 1775; the French revolution deprived him, in 1791, of Avignon and its territory; and in consequence, in January, 1793, the French Ambassador was murdered by the Roman populace, and no satisfaction obtained. In 1796-7, the French marched on Rome, and entered into treaty; but, soon after, the Roman populace murdered General Duphot, attached to the French embassy. The French army now entered Rome under Berthier, and the Roman republic was re-established; the Pope was conveyed a prisoner to France, where he died, in March, 1800.

PIZARRO, a Spanish freebooter, was born about 1500, and, in 1525, he and some other adventurers invaded the peaceful kingdom of Peru; and, taking Ataliba, the Inca, prisoner, they forced him to profess Christianity, and then burnt him; but, as a favour to a Christian, strangled him first. Soon after, this banditti quarrelled among themselves, and Pizarro's brother strangled Almagro, the second in command; but, in 1451, the son of Almagro killed Pizarro at Lima.

PLATO, the most renowned of the Greek philosophers, was born 430 B. C. He studied under Socrates, and, on the murder of that philosopher, went into Italy, and studied in the schools of Pythagoras, and afterwards visited Egypt. He then opened, at Athens, a school called the Academy, and, among his pupils were Aristotle, Lycurgus, and Demosthenes; while Socrates, Xenophon, and Diogenes, were among his opponents. There he taught philosophy till his 79th year, and died in 348. Statues and

altars were erected to his memory, and the day of his birth kept as a festival. His works are in 12 volumes, and there is an English edition by Taylor, in 5 quartos. Plato taught three principles; the cause or mover, matter and form; or two, the cause and matter. He was, in other respects, of the school of Pythagoras and Parmenides. The Academical Philosophy is so called from Plato's place of teaching, a grove of one Hecademus, bequeathed for gymnastic exercises.

John PLAYFAIR, Edinburgh Professor of Mathematics, was born in 1748, and was, in many respects, one of the most active and original natural philosophers of his age; he died in 1819.

There were two PLINYS, uncle and nephew, or elder and younger. The first was born, A. D. 22, at Verona; and he wrote a history of his own time, and a Natural History, which last is still extant. He lost his life by his curiosity in ascending Mount Vesuvius, during an eruption.—Pliny the younger died A. D. 103, and there remain his letters, and his panegyric on Trajan.

PLUTARCH, the biographer and historian, was born in 50 A. C.; and, after extensive travelling, he settled at Rome, where he taught philosophy, and was promoted by Trajan; he died in 119.

POLYBIUS, a Greek classic historian, was born 203 B. C. He wrote a Universal History, during 135 years, in 12 books, of which only five are now complete; he died in his 82d year.

POMFRET, the author of the Choice, &c. was born in 1667, and died of the small-pox, in 1703.

Madame POMPADOUR, famous as the mistress of Louis XV. She was born in 1722, and, in 1745, was created marchioness. She promoted literature and the fine arts; had a pension of 10,000*l.* per annum, and the office of Lady of the Palace to the Queen. She influenced every thing, even war and peace, and died in 1764.

POPE, Alexander, the prince of English poets, was born in Lombard-street, in 1688. His father being a linen-draper, and a Catholic, his education was liberal, chiefly under Romish priests. He became an author at 12, and published his principal works between 1705 and 1742; he died May 30, 1744. He was small and deformed in person, with a very delicate constitution; but his transcendant genius rendered him the spoiled child of the age in which he lived.

PORPHYRY, a distinguished writer, was born at Tyre, in 233. He wrote against the use of animal food, the Life of Pythagoras and Plotinus, together with some very strong Tracts against the Christian religion; he died about 304.

Richard PORSON, celebrated for his memory, learning, and eccentricity, was born in 1759, and died in 1808.

Baptista Della PORTA, an active philosopher, in a superstitious age, was born at Naples, in 1415. He invented the camera-obscura, a near approach to the telescope and published some highly-curious works; died in 1515.

PORTEUS, Bishop of London, and son of the Captain Porteus, whose name is connected with the history of Edinburgh, was born at York, in 1731. In 1759, he wrote his beautiful poem on Death; and, in 1787, was made Bishop of London; he died in 1808.

POTTER, Archbishop of Canterbury, and author of several learned works; was born in 1674, and died in 1747.

There were two POUSSINS, French painters; Nicholas, the principal, who was born in 1594, and died in 1665; and Gasper, his brother-in-law, who was born in 1600, and died in 1675.

Charles PRATT, the first Earl Camden, and many years Chief-Justice of the Common Pleas, was born in 1713, and died in 1794, after a life distinguished by the independent exertion of sound principles.

The Abbé PREVOST, the most fertile of modern writers, was born in 1697, and his works and compilations extend to 156 volumes; he also translated the novels of Richardson. In November 1763, he fell down in an apoplectic fit, in the forest of Chantilly, when an ignorant magistrate ordered a surgeon to open his body; on which he started with pain, but not before he had received mortal wounds.

Dr. Richard PRICE, a learned Dissenter, was born in 1723. He officiated to a dissenting congregation at Hackney, established the Equitable Assurance Company, suggested the Sinking-fund scheme, and wrote some political tracts, dying in 1791.

Dr. Joseph PRIESTLEY was born in 1733. In 1761, he became Tutor in the College at Warrington, and there wrote several works, after which he resided six years at Leeds, and discovered the composition of air. In 1773, he became Librarian to Lord Shelborne, and his discoveries in air produced him great distinction. In 1778, he removed to Birmingham, and there wrote his History of the Corruptions of Christianity, and other works. But, in 1791, a Church-and-king mob burnt his house and library, and he removed, first to Hackney, and afterwards to Pennsylvania, where he died, in 1804.

PTOLEMY, the astronomer, was born in Egypt, in 70 A. C. His works convey the best notions of the state of ancient science; he died about 150.

Henry PURCELL, the English musical composer, was born in 1658, and died in 1695. His Te Deum Jubilate, Orpheus, Britannicus, and King Arthur, were his principal works.

PYRRHO, a Greek philosopher, who accompanied Alexander the Great; and, imbibing the Eastern philosophy, founded a sect, and died 288 B. C.

PYRRHUS reigned in Epirus about 300 B. C.; and, in 280 B. C. invaded Italy, and again in 270; but, at length, he was killed at Argos.

PYTHAGORAS the earliest Greek philosopher, was born about the year 600, and lived to be fourscore. The fables about him render him almost an ideal personage; he was born at Sidon, and educated at Samos; he then passed 25 years in Egypt, and visited India; he taught the doctrine of transmigration and abstinence from animal food; he was the inventor of the multiplication-table, and a great improver of geometry, while in astronomy he taught the system adopted at this day; he also discovered the diatonic scale in music; he enjoined five years retired study to his disciples. Pythagoras was founder of the Italian School; Thales, of the Ionic or Greek School of Sophi.

PYTHIUS, of Marseilles, made a voyage to Thule (Iceland) where he found the Sun did not set at the summer solstice.

QUINTILIAN, a Roman classic, was born about 42. He disgraced his learning by praising Domitian, and died 122.

RABELAIS, a distinguished French writer, was born in 1483, and died in 1543.

RACINE, the French Dramatist, was born in 1639, and died in 1699. His works were numerous, and are still performed.

Sir Walter RALEIGH was born in 1552, and served in the English army in Ireland. He afterwards, in 1584, founded the first settlement in Virginia, calling it after Queen Elizabeth; and, on his return to Europe, brought with him tobacco and potatoes, which he planted on his estates near Cork. He was employed in many other public services, but not being fancied by the new Scotch Court, he was charged with being privy to a conspiracy for placing Arabella Stewart on the throne. The indictment was for misprision of treason, but a base jury found him guilty of treason. In consequence, Sir Walter was imprisoned twelve years in the Tower, during which, he wrote his History of the World. Bribing Villiers, he obtained the command of an expedition to Guiana, but, on his return, in July 1618, was arrested, at the instigation of the Spanish ambassador, for attacking a Spanish settlement, and ordered to be executed under the former verdict for treason, obtained sixteen years before, at which time Bacon was Lord-Keeper. This legal murder, of the greatest man of his age, took place October 29, 1618.

RAMEAU, a celebrated French composer, and illustrator of the science of music, was born in 1683, and died in 1754.

Allan RAMSAY, the Scottish poet, was born in 1685; and, in 1721, he published his poems, and soon after, his Gentle Shepherd; he died in 1758.

RAPIN, the French historian of England, was born in 1661; he began his history in 1707, and lived to complete eight volumes, quarto, to the death of Charles I. Two other volumes, to the Revolution, were published from his manuscripts, in 1726, after his death.

RAPHAEL, commonly called the Prince of Painters, was born at Urbino, in 1483. The Popes Pius II. and Leo X. patronized him, also a rich banker of the name of Chigi. The number, the splendour, and the astonishing genius of his works, created a sort of idolatry for his person; but, he fell in love with a baker's daughter, and his excesses caused his premature death, in 1520. No less than 740 of his designs have been engraved, and many of his pictures sell at the price of an estate.

The Abbé RAYNAL, an original French writer, was born in 1718. In 1770, he published his History of the East and West Indies. During the revolution, he wrote some pamphlets, and died in 1794.

RAYHIB, Pacha, an able Turkish vizier from 1757 to 1768, when he died, distinguished as a politician and writer.

REAUMER, a distinguished French naturalist, was born in 1683; and, after making many discoveries, inventing a thermometer, and publishing a great work on the history of insects, he died in 1757.

REMBRANDT, the most powerful of the Dutch painters, was born in 1606, and died in 1674.

Sir Joshua REYNOLDS, first president of the Royal Academy, and Founder of the English school of painting, was born in 1723, and died in 1792. The R. A. was established in 1769, and his annual discourses are deservedly admired.

RICHARD I., King of England, was the second son of Henry II., and born in 1157. His youth was marked by the basest conduct to his father, whose heart he broke. This seems to have qualified him for a crusader, and, in 1190, he sailed with a vast army, accompanied by Philip, King of France, for the Holy Land. They took Acre, and obtained some other successes against Saladin. The intrigues of his brother John forced him to return, in 1192, and while traversing Austria as a pilgrim, he was seized and imprisoned, while his brother John, and Philip, King of France, connived at it. In 1194, he procured 150,000 marks for his ransom, and returned to England; and, soon after, entered into a contest with a vassal, Lord of Chalus, and was shot by an arrow during the siege, in April 1199. His ferocious bravery led to his being called *Cœur de Lion*.

RICHARD II. was son of Edward the Black Prince, and grandson of Edward III., whom he succeeded in 1377, in his eleventh year. Spoiled by power and education, the tyranny of his government drove the people to general insurrections; one of which was headed by Wat Tyler, and caused the loss of some thousand lives, and the destruction of immense property; his success, in quelling these, so intoxicated him, that he became as profuse as some of the Roman Cæsars; and, after murdering one of his uncles, Henry, son of John of Gaunt, headed the nation, and Richard was formally deposed in 1399; he was then imprisoned at Pontefract, and soon after put to death.

RICHARD III. was youngest son of the Duke of York, who was killed in the battle of Wakefield, and born in 1450; he was educated amidst the slaughters which attended the wars between the Houses of York and Lancaster; he was 21 at the battle of Tewksbury, which ruined the House of Lancaster, an age at which he was not likely to have committed the murders ascribed to him. On the death of his brother, in 1483, he sacrificed his friends and seized his children, procuring himself to be proclaimed King. Whether he killed the young princes, or whether he sent them abroad, and they were the Perkin Warbec and Lambert Simnel of Henry VIIth's reign, is now uncertain. After sacrificing his creature Buckingham, the crown was claimed by Henry, Earl of Richmond, descended from John of Gaunt, who met him at Bosworth, with a superior force, and Richard was defeated and killed, August 23, 1485.

Samuel RICHARDSON, author of Pamela, Clarissa, and Grandison, was a respectable printer, in London, and died in 1761, aged 72; he was the founder of the prolific school of domestic novelties.

Cardinal RICHELIEU was born in 1585; in 1614, he was made Secretary of State; in 1622, he was created Cardinal; and, in 1624, became Prime-minister to Louis XIII. He persecuted the Protestants, and governed France till his death, in 1642. Marshal Richelieu, of the same family, was born in 1696, and held commands in the wars of Louis XV.; he died in 1788. The last distinguished person of the family was the Duke de Richelieu, born in 1767, who, after organizing Odessa for the Emperor of Russia, became Prime-minister to Louis XVIII. and died in 1822.

Bishop RIDLEY was educated at Cambridge, and made Bishop of London in 1551, he was so zealous a friend of the Reformation, that, on the accession of Mary, he was convicted as a heretic, and burnt with Latimer, at Oxford, on the 15th of October, 1555.—Being consulted by Edward VI. on his death-bed, in regard to the best disposition of charitable funds, he planned for the young King the *four* grand hospitals —of Christ's, for education; of Bridewell, for industry and distress; of St. Bartholomew and St. Thomas, for the sick and maimed.

RIENZI, a Roman of Plebeian birth, who was fired with enthusiasm to restore the ancient Roman republic. In this design he acquired considerable power, and the Pope residing at that time at Avignon, his success was obstructed only by his extravagances, and he was killed in 1354

Joseph RITSON, an English antiquary and philologist, in which he displayed great accuracy of learning and research; he also wrote against the use of animal food: he died in a derangement of fever, caused by erysipelas, in 1803.

David RIZZIO was an Italian musician, and had great talents as a linguist, who, going to Scotland in the suit of the ambassador from Savoy, became a great favourite with the young Queen, Mary, which exciting the jealousy of her husband, Darnley, he and his partizans assassinated Rizzio, in the Queen's presence, in 1566.

Robert BRUCE, King of Scotland, the opponent of the Baliol interest, asserted his claims in 1306, and having gained the battle of Bannockburn over that weak prince, Edward II., he remained King of Scotland, and died, aged 54, in 1329.

William ROBERTSON, the Scottish historian, was born in 1721. He wrote a history of Queen Mary and her son, of Charles V., and of America; also, a disquisition on India, and died in 1793.

ROBESPIERRE, one of the most inexorable politicians recorded in history. He was born at Arras, in 1759, brought up as an advocate, and enjoyed an excellent character. He was a member of the National Assembly; and, in May, 1791, proposed a law to abolish capital punishments. In 1792, he was the leader of the Jacobin Club; and, through the year 1793, he, his brother, and their friends, controlled the committees of government, during which period, France was deluged with blood. Self-defence led to attacks on Robespierre, and he and his party were guillotined, July 28, 1794. After his death, his entire property appeared not to be worth five pounds sterling.

ROBIN HOOD was the head of the free foresters; who, in spite of royal claims, ranged the forests from Nottingham to Barnsley, in the reigns of Richard and John, for a period of 30 years, having a well-trained band of powerful archers in his command. He was long outlawed, and great rewards offered for his apprehension; but, falling ill, he applied to the prioress of Kirklees to bleed him, and she bled him to death. The popular ballads, recording his story, have become traditional in the districts of the northern forests.

Mary ROBINSON, commonly called the British Sappho, and as celebrated for her beauty as her talents, was born at Bristol, in 1758. An indiscreet marriage, in her 15th year, obliged her to resort to the stage, where the Prince of Wales, then 18, and the handsomest man of his age, fell in love with her, and withdrew her from the uncertain protection of her husband; but she experienced the fickleness of princes, and was soon left, with a pension of 400*l*. a-year. She died in 1801.

Admiral Lord RODNEY was born in 1717; in 1759, he bombarded Havre; in 1761, he took Martinique; and, in 1768, he was ruined by a contested election at Northampton. In 1780, he defeated a Spanish fleet off Cape St. Vincent; in 1781, he took St. Eustatia; and, on the 12th of April, 1782, defeated the French under de Grasse. He died in 1792.

Madame ROLAND, a woman of extraordinary talents. At 22, she married M. Roland, afterwards a very able and virtuous Minister of State. She took an active part in favour of liberty during the Revolution;

and, on an accusation being passed against her husband, she presented herself before the Convention, and demanded to be heard in his defence; for which, she was arrested, put on a mock trial, and guillotined, Nov. 1, 1793. Her husband, on hearing of her death, stabbed himself.

Sir George ROOKE, a famous English Admiral, was born in 1650; and, in 1702, he defeated the combined fleets in Vigo Bay. In 1704, he captured Gibraltar, and died in 1709.

Salvator ROSA, a Neapolitan painter, of great original genius, was born in 1615, and died in 1673.

Jean Jaques ROUSSEAU, an eccentric, but eloquent French writer, was born at Geneva, in 1712, where his father was a watch-maker. He became a music-master, and afterwards lived by copying music. In 1752, he wrote a Comedy, and a musical entertainment; and, in 1762, his Julia, or the new Heloise, afterwards the Social Contract, a book on education, a Comedy called Pygmalion, &c. &c., in all, 17 volumes quarto. He died in 1778, extremely popular.

ROWE, Nicholas, an eminent dramatist, was born in 1673. At 24, he produced the Ambitious Step-Mother; then Tamerlane, The Fair Penitent, Jane Shore, Lady Jane Grey, besides a translation of Lucan; he died in 1718.

Mrs. ROWE, cotemporary with the preceding, but no relation, was daughter of a dissenting minister, and born in 1674. In 1700, she married Mr. Thomas Rowe, the son of another dissenting minister. She wrote *Friendship in Death*, *Devout Exercises*, *The History of Joseph*, a poem, and other works; and died in 1737.

RUBENS, the illustrious painter, was born in 1577, and studied his art in Italy. On his return, he was employed and courted, for many years, by all the sovereigns in Europe; his works are so numerous, without being less perfect, that more than 300 of them have been engraved; he died in 1640.

Count RUMFORD, whose family-name was Thomson, and native country New England, was born in 1752. In 1799, he published his experiments on Heat, and planned the Royal Institution. In 1802, he settled at Paris, married the widow of Lavoisier, and died in 1814.

Lord William RUSSELL, known as a patriot, was the third son of the fifth Earl of Bedford, and born in 1641. He was member for Bedfordshire in four Parliaments, and 1679 was made one of the privy-council; but, in 1680, he went to Westminster Hall, and presented the Duke of York as a popish recusant, and also carried up the exclusion-bill, at the head of 200 members, to the House of Peers. He was, in consequence, imprisoned on the ridiculous Rye-house Plot, for which he was tried before Jefferies, and a packed jury, and convicted and executed.

Admiral RUSSELL, Earl of Orford, was born in 1651. In 1692, he gained the victory of La Hogue; he died in 1727.

SABATIA, Sevi, was a Jewish impostor, who, in the 17th century, announced himself as the Messiah, in Turkey, being followed by multitudes. He was taken before the Sultan, to whom he declared his power of working miracles. The Sultan then ordered him to be tied to a post, and fired at, challenging his power; when Sabatia confessed his imposture.

Dr. SACHEVEREL, a theological politician, created a great flame in the reign of Queen Anne, by preaching two sermons about the danger of the Church from the Dissenters; for which, he was prosecuted by the House of Commons, a circumstance which rendered him the most popular man of his time; he died in 1724.

There were two SACKVILLES, Earls of Dorset, both very accomplished; one Thomas, born in 1537, and favoured by Elizabeth, who died in 1608, author of various poems, and a Tragedy. The other, Charles, was born in 1637, at once a polite writer, and a friend of Milton, Butler, Prior, Dryden, Congreve, and Addison; he died in 1706, and his son was created Duke of Dorset. The family-seat, Knoll, exemplifies his taste in his collection of portraits.

SADI, the Persian poet, according to the oriental legend, went forty pilgrimages to Mecca on foot from Shiraz, and studied for 30 years, travelled for 30 years, and passed 30 years in devotion. He was taken prisoner by the Crusaders, and died in 1296, nearly 100. His chief poems are the *Garden of Roses*, and the *Garden of Fruits*.

SALADIN, the Sultan of Egypt and Syria. He was opposed to the Christian fanatics in Palestine, and excited by their massacre of pilgrims going to Mecca. His first victory was at Tiberius, in 1187, where he cut down Guy de Lusignan with his own scymitar, and many more Christian chieftains; and, among others, Chatillan, the author of the massacre. He then took Acre and Jerusalem, but was opposed by Richard Cœur de Lion, with whom he made a truce, and died in 1193.

SALLUST, the Roman historian, born 55 B. C.

SAPPHO, the Thespian poetess, flourished in the 5th century, B. C.

Professor SAUNDERSON, of Cambridge, is famous as a blind man who taught mathematics, and was among the ablest of his age. He died in 1739, aged 57.

George SAVILLE, marquis of Halifax, and a noted statesman, was born in 1603, and filled various high stations in the government under the Stuarts, but he Promoted the revolution; he died in 1695.

Marshal SAXE was the natural son of Augustus, King of Poland, and born in 1696. In 1744, he commanded at Dettingen, and, in 1745, defeated the Duke of Cumberland at Fontenoy, and over-ran Flanders; he died in 1750.

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There were two SCALIGERS, famous classics and critics. The father, Julius Cæsar, born 1484, near Verona, and died in 1558. His son, Joseph Justus, was born in 1540, and died in 1609. Their editions and notes on the classics are very numerous.

SCHILLER, the celebrated German dramatist, was born in 1759; and, after writing the Robbers, Wallenstein, Fiesco, Cabal and Love, Don Carlos, and some historical works, died May, 1805.

Marshal SCHOMBERG, who was killed at the battle of the Boyne, had commanded French armies in Spain, and the Netherlands; but, being a Protestant, he left France on the revocation of the edict of Nantz; and, coming to England with William III., was created a duke, and sent as commander in Ireland, where he was killed by a chance shot, July 1, 1690.

SCIPIO, Africanus, was the commander of the Roman forces in the first invasion of Africa, and he defeated Hannibal at Zama. After making peace, he was honoured with a triumph; but, being assailed by party, he retired from public life, and died 189 B. C. His brother, Lucius Cornelius, was surnamed Asiaticus, for his victory over Antiochus at Magnesia. There was, also, a third Scipio, who was the son of Paulus Æmilius; but adopted by the son of the first Scipio, and therefore took the name. He was the commander who destroyed Numantia, and who afterwards took, and, in so barbarous a manner, destroyed Carthage; he was found dead in his bed 129 B. C., in his 56th year.

SCOTT, Sir Walter, a very ingenious and tasteful, though voluminous writer of Tales and Romantic Histories, in verse and prose, adapted to the amusement of females, and persons who, in books, seek mere pastime. He possessed neither the deep philosophy of Shakespeare, the satire of Swift, the sound reasoning of Pope, the humour of Fielding, the human sympathies of Richardson, or the wit and design of Voltaire; yet, by writing under the mystery of the Great Unknown, and by a commercial union with musical composers, dramatists, and journalists, he enjoyed, in his day, as unbounded a popularity as Lope de Vega. Seduced by the enormous profits which the unsated patronage of the world conferred on his works, he wore himself out, and died of mental and bodily exhaustion, in 1832, at the age of 61.

John SELDEN, a learned legal and political writer, was born in 1584, and died in 1654; he wrote on the ancient constitution of England, the history of tithes, a work on the Arundel marbles, an answer to Grotius on the Freedom of the Sea, and took part in the civil wars against Charles I.

SENECA, a wealthy Roman philosopher, who was tutor to Nero, and wrote some excellent moral and philosophical works, but, being suspected by Nero, he was allowed to choose his death, and he was bled to death in a warm bath.

Edward SEYMOUR, Duke of Somerset, was brother of Lady Jane, third wife of Henry VIII., and, therefore, uncle of Edward VIth., to whom he was an able prime-minister; and, also, a zealous friend of the reformation. Jealousy created him enemies among the nobility, which led to his death on the scaffold, in 1552.

Michael SERVETUS, a literary Spaniard, was born in Arragon, in 1509. At 22, he wrote a Tract against the Trinity; and, soon after, graduated at Paris, as a physician; he was the correspondent of Calvin, during the time of their mutual heresies, before Calvin fled to Switzerland; but, afterwards, Servetus went a step further than Calvin, and therefore found, in Calvin, a bitter enemy. In 1553, he published a work, for which Calvin stirred up a prosecution, and obliged Servetus to leave Vienna for Naples; but, passing through Geneva, Calvin, who was all-powerful, procured him to be arrested, and he was, on the evidence of letters to Calvin, and of forced constructions of his works, sentenced to be burnt alive: a deed which was perpetrated on the 27th of October, 1553. Servetus gave the first idea of the circulation of the blood, and of the functions of respiration.

Madame DE SEVIGNE, the celebrated letter-writer, was born in 1626, and died in 1696.

The SFORZAS were a distinguished family in Italy, whose founder, the son of a shoe-maker, becoming a soldier, so advanced himself as to become a general and a count, also constable of Naples, but he was drowned, in 1424; his natural son succeeded him, and became Duke of Milan, and, dying in 1466, his descendants long enjoyed that sovereignty.

There were two Lord SHAFTESBURYS; one, who was born 1621, and, after filling various public employments, died in Jan. 1683. The other, and third earl, was his grandson, born in 1671, and died in 1713; he was author of the Characteristics, and other works.

William SHAKESPEARE, one of the most extraordinary geniuses that ever appeared in the world, was the son of an industrious wool-stapler, who had a large family, at Stratford-upon-Avon. Before he was 18, he married Anne Hathaway, and, according to the custom of that part of the kingdom, where foresters' habits still prevailed, he engaged in deer-stealing; not upon a principle of thieving, but on a claim of natural right, asserted by the common people from all antiquity. Being in danger of a prosecution, he fled to London; and, from the employment of holding horses at the door of the theatre, became, first, an actor, and then an author; his first play was Hamlet, written about 1594, in his 30th year; his second, Romeo and Juliet; and these were followed, in 1596, by Richard the Second, and Richard the Third. He continued to write till about 1612, when he retired, and settled at Stratford, but died on the day he completed his 52d year, April 23d, 1616; he left three daughters, who died without

children; but, his sister Joan left a large family, who still live in the neighbourhood, without deriving any advantage from their descent.

Granville SHARP, an amiable enthusiast, was born in 1734, and, in 1770, he had the glory of defending a negro, whose slavery had been asserted in England; and he established the principle of law, that there can be no slaves in England. He then headed a society to abolish the slave-trade, and, after 30 years' unwearied labour, succeeded in his object.

Richard Brinsley SHERIDAN was the son of Thomas Sheridan, a literary player and dramatist, and born in Dublin, October, 1751; he was educated at Harrow, and, before his 30th year, produced the Rivals, the Duenna, the School for Scandal, and the Critic. In 1780, he became M. P. for Stafford; and, from that time till his death, distinguished himself by displays of extraordinary talents as a senator, in which he always supported the liberties of the people with a disinterested zeal, which has never been exceeded. Surviving his friends, he died neglected, in 1816.

William SHIPPEN, a very eloquent patriotic member of the House of Commons, was born in 1672; and, after serving in many Parliaments, with zeal and great ability, he died in 1741.

Sir Philip SIDNEY, a chivalrous and accomplished hero of the age of Elizabeth, was born in 1551, and killed at Zutphen, in 1586.

Algernon SIDNEY, an English patriot, was born in 1617, and, joining the republicans, in the civil wars, he held various appointments, and was one of the High Court of Justice for trying Charles I. After the Restoration, he retired abroad; but, being permitted to return, in 1677, he was, on the following year, charged with being a party in the Rye-house plot, and convicted, but on imperfect evidence. He was, in consequence, executed on Tower-hill, December 7, 1678, leaving a much-honoured fame.

SILIUS ITALICUS was a Latin poet, whose work on the Punic War still exists; he died in 90 A. D.

St. SIMON, a late French visionary, was born in 1760, and died in 1825. He went with Fayette to America, in 1779, and, on his return, was made a colonel. He took no subsequent part in political affairs, and, for 31 years, devoted himself to the establishment of a new sect of political moralists.

Pope SIXTUS V., born in 1521, was not less remarkable for having kept swine in his boyhood, than for the talents which he displayed as Pope, from 1585 to 1590, when he died.

Sir Hans SLOANE, a distinguished naturalist, president of the Physicians' College and the Royal Society, was born in Ireland, in 1660, and died in 1752.

Dr. Adam SMITH, a noted Scotch writer, was born in 1723, and died in 1790. He wrote a work on moral sentiments, and another on the origin of languages, and a dissertation on the *Wealth of Nations*, which last work was useful as a speculation, but unhappily has laid the foundation of an impracticable practical science called Political Economy.

Dr. Tobias SMOLLETT was born in 1721, and after going as surgeon to the West Indies, he settled in London, as an author, and produced *Roderick Random*, *Peregrine Pickle*, *Humphrey Clinker*, his *History of England*, and other works; he died in 1771.

SOCINIS, founder of the Socinians, was born in 1639, in the Roman territory, which he quitted with his uncle, on account of their peculiar opinions. They removed into Switzerland, Germany, and Poland. At Cracow, the publication of his Unitarian doctrines occasioned his house to be destroyed by the mob; but, having created a large party, he died in 1609.

SOCRATES was born 469 B. C., and was originally a statuary; but, studying philosophy, he became so eminent for his wisdom, that, exciting the jealousy of the priesthood, he was sentenced to be poisoned, which took place 369 B. C.

SOCRATES and Archilaus made principles infinite, and ascribed generation and corruption to mixture and separation.

SOLON, a celebrated Athenian, was born in the sixth century, B. C., and was archon in 594 B. C., and in that office he reformed the laws, and remodelled the constitution, and died, aged 80, at Cyprus.

SOPHOCLES, the Greek tragic poet, was born 491 B. C., and died 407 B. C. Only 7 of 100 of his tragedies have survived to our time. His morals may be judged by the following lines. The portrait of the just feelings of a good wife, by Sophocles, deserves to be known :—

Faithful—as dog, the lonely shepherd's pride;
True—as the helm, the bark's protecting guide;
Firm—as the shaft that props the towering dome;
Sweet—as to shipwreck'd seamen land and home;
Lovely—as child, a parent's sole delight;
Radiant—as morn that breaks a stormy night;
Grateful—as streams that in some deep recess,
With rills unhop'd the panting traveller bless.

JOHANNA SOUTHCOTT, a cunning impostor, born in 1750, and died in 1814. Though grossly ignorant, she fancied herself the woman of the Revelations, and gave seals to her disciples; and, on having a disorder of the womb, she gave out that she was pregnant of Shiloh, and thousands became her frantic disciples.

SOSENES, of Alexandria, was the mathematical arranger of the calendar for Julius Cæsar. Pope Gregory XIII., in 1581, struck out 10 days gained by the odd minutes in leap-years, and, in 1752, 11 days were dropt in England.

SPENSER, author of the *Faery Queen*, and other works, was born in 1553, and died in 1589.

SPINOSA, a learned Jew, was born at Amsterdam, 1629. Having renounced the Jewish religion, he applied himself to philosophy, and, after publishing various works,

in which he maintained that God and nature were the same, he died in 1677.

Madame de STAEL, a popular modern writer, was the daughter of the famous Necker, and was born in 1766; her husband was a Swedish ambassador at Paris, and she soon distinguished herself by some political writings. After the revolution, she published her *Delphine*, *Corinne*, and other works, which were very popular, and she died in 1817.

Sir Richard STEELE, author of the Tatler, and joint writer of the Spectator and Guardian, and of many dramatic pieces, was born in 1671; and, after a life of great variety, died in 1729.

The STEPHENSES were a family of learned printers, editors, and critics. Henry, the founder, was a printer at Paris, and died in 1520. His three sons, Francis, Robert, and Charles, succeeded him; and Robert, born in 1503, acquired great celebrity, dying in 1550. It was he who divided the New Testament into verses, which he performed on horseback, while riding from Paris to Lyons. His son Henry, born in 1528, was still more celebrated as a man of learning, but he died in an alms-house, in 1598; his son Paul had a printing-office at Geneva, and was also a man of letters.

STERNE, the author of the *Sentimental Journey*, and of the admirable novel of *Tristram Shandy*, was a Yorkshire clergyman, born in 1713, and died in 1768.

There were two STRABOS, one a geographer, who lived in the first century; and the other a monk, who lived in the 9th, a poet and prose-writer.

Lord STRAFFORD, whose fate led to that of Charles I., was of a Yorkshire family. In 1593, he commenced his career as a zealous patriot, and was one of the chief promoters of the *Petition of Right*. On the death of his enemy Buckingham, he became a Court favourite, and was made President of the North, and Lord Deputy of Ireland. For abuses of power, he was attainted, and beheaded in 1641.

STRUENSEE, a Danish physician, who, through Queen Matilda, directed the affairs of Denmark, in concert with Count Brandt, from 1769 to 1771. By a conspiracy of the Danish nobility, Struensee, Brandt, and the Queen were arrested, and the two former put to death; the latter being allowed to retire to Zell, till her death, in 1776.

Simon STYLITES, was an insane zealot, who, in the 12th century, passed a life of self-devotion at the top of a high column, and was imitated by Daniel and others; and this was thought so godly, that these wretches were believed to work miracles, and some of them were canonized as saints of the Christian church.

There were two SUETONIUSES, one a successful and cruel general, the same who vanquished Boadicea, about the year 60; and the other a polite writer, and biographer of the Cæsars.

Emanuel SWEDENBORG, a Swedish visionary, was born in 1688; and, after writing many mystical books, and establishing the New Jerusalem Church, he died in London, in March 1772; he pretended to hold converse with angels, and with the spirits of the most eminent characters. He abstained from the use of animal food.

Dean SWIFT, distinguished by his various writings, was born in 1667; and, after mingling with political parties, and producing many works of extraordinary genius, he fell into a state of idiotcy, in 1736, and died in 1745. His works make 19 volumes, octavo.

SYLLA, a celebrated Roman, was born 130 B. C.; in 88, he was Consul, and quarrelled with Marius, which led to a murderous civil war, in which Sylla put to death vast numbers of the highest rank and merit, and became Dictator.

TACITUS, the Roman historian, was born A. D. 56; his history is from Galba to Domitian inclusive; his annals extend from the death of Augustus to that of Nero, but they are imperfect.

TALIESEN, the Welsh Bard, many of whose works are preserved in Owen's Archæology, flourished in the 6th century, at Llanfihangel.

The TARQUINS, famous in Roman history, were of commercial origin. Priscus became King of Rome; and, after a long reign, was killed, 570 B. C. Superbus, his grandson, succeeded 584 B. C.; but, his son ravishing Lucretia, in 509 B. C., he was banished.

Jeremy TAYLOR, the son of a barber at Cambridge, and born in 1613. He was patronized by Laud, and on the ruin of his party he fled into Wales; but, at the Restoration, was made Bishop of Down. He died at Lisbon, in 1667; his works are still popular.

William TELL, a Swiss peasant, who lives in the annals of patriotism. He flourished at the beginning of the 13th century, and was drowned by an inundation in 1234. His intrepidity aided his country in shaking off the dominion of Austria; but the story of the apple has been doubted, for the very same circumstances are related by Saxon Grammaticus, about 100 years before, in relation to one Tacco, a Dane. That Tell was the man who shot Gesler, is a fact more certain.

There were three TENIERS, most ingenious painters of the Dutch school. The father, David, was born in 1582, and died in 1619; his son David was born in 1610, and after excelling his father in the same line, died in 1694.

TERENCE, the Latin dramatist, was born in 194 B. C., and was originally a slave.

TERTULLIAN, a father of the Church, flourished in the 2d century, but his writings are in little estimation.

THALES, one of the earliest Greek philosophers, flourished in the 6th century, B. C.; he studied in Egypt, taught the sphericity of the earth, and calculated eclipses. He considered water as the origin of matter,

and that motion produced by mind was the first exciter; he lived to the age of 99.

James THOMSON, author of the *Seasons*, was born at Ednam, in 1700, and removing to London in 1722, he published his *Winter* in 1726. In 1728, his *Summer* and *Spring*; and, in 1730, his *Autumn*. His other works were *Sophonisba*, *Alfred*, *Tancred and Sigismunda*, a poem called the *Castle of Indolence*, and some smaller pieces. He obtained a pension of £100 per annum, and an appointment which yielded him £300 per annum, and died in 1748. His tragedy of *Coriolanus* was posthumous.

The Emperor TRAJAN was a son of a commander under Vespasian, and finally nominated by Nerva as his successor. He succeeded in 97 A. D., and, after various other wars with the Dacians and Parthians, he died in Cilicia, A. D. 117.

Van TROMP, the famous Dutch Admiral, was born in Brazil, in 1597; he fought many battles with the English Admirals, Blake, Monk, and Dean; but, in August, 1653, he was killed in one of them, by a musket-ball. He had a son, CORNELIUS, not less famous, who served under his father, and commanded, in chief, in the war between the States and Charles II., sailing at one time down the channel, with a broom at his mast-head, attacking and burning Chatham, and even threatening London. In 1675, he visited the English Court, and Charles the Second made him a baronet.

Marshal TURENNE was born in 1611; in 1639, he commanded in Italy; in 1645, he gained a great victory at Nordlingen; in 1674, he conquered Franche Compte, and, like a barbarian, devastated the Palatinate, one of the many atrocious acts of modern warfare. He was killed at Salzbach, in 1675.

TURNER, Bishop of Rochester, one of the seven prosecuted by James, and one of three of them, including Saucroft and Ken, who refused to take the oath of allegiance to William, and, therefore, deprived of their bishopricks.

TURPIN, Archbishop of Rheims for 40 years, in the reign of Charlemagne; the pretended author of the Romances of Charlemagne and Roland, but they were not written till 200 years after.

TUSSER, author of 500 Good Points in Husbandry, died in 1580.

TYNDALE, William, an early English Translator of the New Testament, the Pentateuch, and Jonah; for publishing of which he was seized at Antwerp, and burnt at Augsburgh, in 1536.

TYRRELL, James, the author of the English History to the Death of Richard the Third, in 5 vols. folio, died in 1718.

TYRTÆUS, the Athenian Poet, flourished about 700 B. C.

There have been four literary TYTLERS, Henry William, a physician and poet, who died in 1808; James, who died in America, in 1805; William, a critical historian and poet, who died in 1792; and Alexander Frazer, Lord Woodhouselee, who died in 813.

UBALDINO, a celebrated illuminator on vellum, flourished in England in the reign of Elizabeth.

ULLOA, Don, who, in 1735, was sent with Don Juan to measure a degree at the equator, and published an account. He died Governor of Louisiana, in 1795.

ULUGH BEY, a Tartar Prince, who cultivated Astronomy at Samarcand, and was murdered in 1447.

USHER, Archbishop of Armagh, a voluminous writer, and very learned divine, was born in 1580, and died 1656.

USTARIZ, the first writer on Political Economy, published his Theory of Commerce, at Madrid, in 1742, and translations appeared in Paris and London. It was the basis of the work of Adam Smith.

There were four VAILLANTS, one, Francis the African traveller, who died in 1824; John Foi, who wrote learnedly on Numismatics, and died in 1706; Sebastian, a botanist, who died in 1722; and Wallerant, a painter, who died in 1690.

VALAZE, an amiable member of the French Convention, who, in 1790, visited England to study Platonism under Thomas Taylor; but, returning to France, was chosen a member of the Convention, and being proscribed with the Girondists, he stabbed himself before the bloody Revolutionary Tribunal, in October, 1793.

There were two VALDERVELDES, father and son, celebrated for sea-pieces. The first died in 1693, and the latter in 1707.

VALENTINE, the Alchemist, who discovered antimony, flourished in the 15th century, at Erfurt.

VALLENCY, the Irish antiquary, was born in 1721, and died in 1812.

VALMIKI was a very early Hindoo poet, who wrote an epic poem, called the Ramayana, of which two books have been translated.

VANBRUGH, Sir John, Architect and Dramatist, died in 1726; he wrote the Relapse, Provoked Wife, Esop, Confederacy, and Provoked Husband. He built Blenheim and Castle Howard.

There were two brothers VANDERWERF, Adrian and Peter, famous for small history; one died in 1722, and the other in 1718.

VANDYCK, Sir Anthony, the Prince of Portrait Painters, was born at Antwerp, in 1599, and died in 1641.

VANE, Sir Henry, was a distinguished patriot, born in 1612; and barbarously put to death, in 1662.

VAN-GOYEN, a Dutch landscape painter, died in 1656.

VANINI, a Neapolitan, who wrote in France some free works on Theology, which the clergy called atheistical; and, to their everlasting disgrace, he was burnt alive at Toulouse, in 1619.—Vanini was the last victim on a charge of Atheism, having published "that God is the beginning and the end; the father of both, without need of either; eternal, without time; in no one

place, yet present every where; creating all and governing all." This, however, was not the God of the Romish church; so, also, Anaxagoras was obliged to flee for his life, for asserting that Apollo did not lead the sun in a chariot drawn by horses.

VALNOO, the Historical Painter, died in 1746; he had a brother Charles, and a son and nephew, also distinguished painters.

VARRO, a learned Roman, who died 27 B.C., aged 90. There was another Varro Atacinus, a poet of distinction.

VASARI, a painter, and author of the Lives of the Painters, died in 1574.

VATTEL, the Expounder of the Law of Nations, died, in 1767, at Neufchatel.

VAUBAN, Marshal, celebrated as an Engineer, died in 1707, aged 74.

VEGA, Lopez de la, the Spanish poet, famous for his genius and industry; his miscellaneous works forming 22 volumes in 4to., and his dramatic 25 volumes. He died in 1635.

VELASQUEZ, the Spanish painter in History and Portrait, died in 1660.

VERNON, Admiral, took Porto-Bello in 1739, and died in 1757.

VESPASIAN, the Emperor, died in 79, after a reign of 10 years.

VESPUCIUS, Amerigo, a Florentine Navigator, whose name was given to the new world, owing to Brazil being marked on the charts, Amerigo's Land. In 1497, he made a voyage, and discovered Terra Firma. He afterwards coasted Brazil to Patagonia, which was first called Amerigo's Land, and then America. His four voyages and letters have been published.

VIDA, a Latin poet, died 1566.

VILLARS, Marshal, the antagonist of Marlborough, in 1708 and 9. He died in 1734.

VILLIERS, George, first Duke of Buckingham, third son of Sir George Villiers, born in 1582, and favourite minister of James I. and Charles I., till he was killed by John Felton, in 1628. His son, who was a reprobate favourite of the dissolute Charles II., wrote the Rehearsal, and died in 1683.

VINCI, Leonardo da, a distinguished Painter, was born in 1452, and died in 1520, in the arms of Francis the First.

VIRGIL, or Publius Virgilius Maro, the principal Roman Poet. He was born 70 B.C., near Mantua. At first he studied philosophy; at 33, he wrote his Eclogues, then his Georgics, and, at 45, his Æneid. He was patronized by Pollio, Mecænas, Augustus, and Octavia. He died 19 B.C., aged 51.

VISHNOO-SARMA, a Brahmin of a very early age, who wrote the Fables and Apologues of Pilpay, or Bidpai.

VITRUVIUS, the Architect, flourished in the time of the two first Cæsars.

VOLNEY, Count, was born in 1755. He published Travels in Syria and America, and wrote a much-read work called Ruins. He also published new Researches in Ancient History, exposing the errors of the Jewish chronology, and other works. He died in 1820.

VOLTA, the experimental philosopher was Professor at Pavia, and died in 1826.

VOLTAIRE, a Dramatist, Poet, and Philosopher, was born in 1694, and died in 1778. He was, for 50 years, the most popular writer in Europe. His works extend to 71 volumes octavo, and are constantly reprinted. His Philosophical Dictionary was lately published in six volumes, in London.

There were several writers of the name of VOSSIUS; the first and most eminent was Gerard John, born 1577, who died in 1649, and wrote ably on many subjects; and his son Isaac was born in 1618, and died 1688, after publishing many learned works.

WAINFLETE, William, Lord Chancellor and Bishop of Winchester; but, memorable as the Founder of Magdalen College, Oxford. He died in 1486.

WAKEFIELD, Gilbert, a learned Critic, and honest Political and Theological writer; born 1756, and died 1801.

WALKER, George, the Irish Divine, who defended Londonderry, in 1689, against King James; he was afterwards killed at the battle of the Boyne, 1690.

WALLACE, Sir William, the Scottish Patriot, opposed to Edward I. He was made Regent for John Baliol, but defeated at Falkirk; and, being taken, was barbarously put to death in London, in August, 1305.

WALLER, the Poet, was born at Coleshill, in 1605; and, having a large estate, made love to Lady Dorothea Sidney, whom he celebrated as Sacharissa. He suffered in the civil wars, and died at Beaconsfield, in 1687.

WALLIS, John, a mathematical philosopher of great eminence, was born in 1616, and died in 1703.

WALPOLE, Sir Robert, one of Queen Anne's ministers, and prime-minister to George I. and II.; died, Earl of Orford, in 1745, aged 69.

WALPOLE, Horace, his third son, a dilletanti man of letters; was born in 1718, and died in 1797.

WALSINGHAM, Sir Francis, a statesman in the age of Elizabeth; died in 1590, aged 90.

WALTON, Isaac, a gossiping, superstitious writer, of the age of Charles I., who wrote two or three over-praised books on angling, &c.

WARBURTON, Bishop of Gloucester, a man of much temporary note, as the friend of Pope, Allen, &c. His works are chiefly professional. He died in 1779.

There were two WARTONS, brothers, Joseph and Thomas. The first, who died in 1800, was master of Winchester school, and Editor of Pope's Works. The second, who died in 1790, was poet-laureate, and wrote the History of English Poetry, besides critical works.

WASHINGTON, George, commander of the American armies, and first President of the United States,—a man of the happiest union of good qualities. After a life of unsullied glory, he died, Dec. 1799, aged 68.

WATSON, Bishop of Llandaff, a philosopher and theologian, author of Chemical Essays; he died in 1816.

WATT, James, the improver of the steam-engine, and inventor of many machines, died in 1819.

WATTS, Isaac, a laborious writer and pleasing poet, born 1674, and died in 1718.

WEBER, author of Der Freischutz, was born in Holstein, in 1786, and died in London, in 1826.

WENTWORTH, Earl of Strafford, Lord Deputy of Ireland, 1632; and, subsequently, adviser of Charles I.; was impeached in 1640, and beheaded 1641.

WERNER, the founder of Mineralogy and Geology, as modern sciences, was born in 1750, and died, in 1817, at Freyburg.

WESLEY, John, a religious enthusiast, and an excellent man, who, for 60 years, preached through the three kingdoms, and increased the sect of Methodists; he died in 1791, aged 88.

WEST, Benjamin, a celebrated painter, and President of the Royal Academy; was born, in Pennsylvania, in 1738, and died, in London, in 1820.

WHISTON, William, successor of Newton as mathematical professor at Cambridge, but displaced for Unitarian doctrines; he died in 1752, aged 85.

WHITFIELD, George, the enthusiastic founder of Calvinistic Methodism, in the propagation of which he preached through this kingdom, and the United States, for 30 years; dying, in New England, in Sept. 1770.

WHITTINGTON, Richard, Sheriff of London in 1389; and Lord Mayor in 1397, 1406, and 1420, celebrated as a runaway scullion-boy, who afterwards acquired great wealth as a merchant.

WICKLIFFE, John, the first English Reformer, died in 1384; he was protected by John of Gaunt, Edward's son and Richard's uncle, yet virulently persecuted by the church, and rescued from martyrdom only by a paralytic attack, in his 60th year.

WIELAND, C. M., the Voltaire of Germany, whose works, in prose and verse, make 42 vols. 4to.; he died in 1813, in his 80th year, near Zurich. In 1808, Napoleon considered it an honour to breakfast with him.

WILKES, John, was an English demagogue, before and during the American war, who outlived his professed principles, and died, Chamberlain of London, in 1797, aged 70.

WILLIAM I., King of England, who, two centuries after, was, by venal writers, called *the Conqueror*, was natural son of Robert, Duke of Normandy, by Arlotta, daughter of a tanner of Falaise; he was born in 1024, and, in 1035, was adopted as heir to the dukedom. In 1065, Edward, the doting Confessor, bequeathed him the crown of England, in prejudice of his nephews, Tosti and Harold; and William, landing with an immense army, defeated and killed Harold, at Hastings, Oct. 4, 1066. He then treated the nation as a conquered country, seized on all the lands, &c. and distributed them among his rapacious followers, who asserted their claims with fire and sword, and entrenched themselves in castles throughout the kingdom. After a tyrannical reign, he was killed, in a murderous affray, by a fall from his horse, near Rouen, in 1087.

WILLIAM III. was Stadtholder of Holland, and son of Mary, daughter of Charles I., therefore nephew of James II., whom he expelled in 1688. He also married Mary, the daughter of James, in 1678. On July 1, 1690, he defeated James at the battle of the Boyne, and his admiral, Russell, destroyed the fleet of James' ally, Louis XIV., in 1692, at La Hogue. The war was terminated, by the treaty of Ryswick, in 1696; but, in 1701, the King of Spain having bequeathed his crown to the grandson of Louis XIV., William stirred up a confederacy against France; but, before it was in action, he was killed, by the fall of his horse, March 6, 1702.

WILLIAM OF NASSAU, founder of the Dutch Republic, opposed the Spanish Viceroy, Alva; and, in 1579, procured a recognition of the independence of the Seven Provinces. He was killed, by a Spanish emissary, in 1584; and succeeded, as Stadtholder, by his son Maurice.

WILSON, Richard, the English Claude, was born in Montgomeryshire, in 1714; and, after a life of destitution, died in 1782.

WINCKELMANN, a celebrated antiquary, was a shoemaker, born in Brandenburgh, in 1718; and murdered in an inn at Trieste, for the sake of some gold medals, in 1768.

WISHART, George, was a Scottish gentleman, and man of learning; who, being tried at Edinburgh for heresy, was burnt alive, March 1, 1546.

WITTIKIND was the Pagan chief of the Saxons, against whom the bigot, Charlemagne, made war; and, overcoming, caused him to be baptized. He was killed in 807.

WODEN was chief of certain tribes in Caucasus, allied to Pontus, and Pompey forced him to emigrate into Sarmatia and Saxony, about 60 B. C.

WOLCOT, John, better known by his literary name of Peter Pindar, was born in Devonshire, in 1738; he wrote *the Lousiad*, and a series of satirical poems, which enjoyed unparalleled popularity, and died in 1819.

WOLFE, General, the conqueror of Canada, was killed, before Quebec, in 1759, in his 34th year.

There have been six German writers of the name of WOLFIUS, properly WOLFF; the chief of them was Christian, the mathematician, born 1679, and died 1754.

WOLSEY, Thomas, Cardinal, Lord-Chancellor, Archbishop of York, &c. &c. was a butcher's son at Ipswich, and born in 1471. For 20 years, from 1509 to 1529, he was minister and master of Henry VIII.; but, offending him about Anne Boleyn, he was disgraced, and, being arrested for high-treason, he took poison at Sheffield Castle, and died, at Leicester Abbey, in Nov. 1530.

WOLLASTON, Dr. Thomas, a very active and acute experimentalist, contempo-

rary with Davy and Young, inventor of the scale of Equivalents, and author of many able papers in the Transactions of the Royal Society; he died, aged 65, in 1829.

WOODVILLE, Anthony, Earl Rivers, was brother of Elizabeth Grey, whom Edward IV. married, and a distinguished patron of letters, and the art of printing. To assure the coronation of his nephew, Edward V., he had prepared some forces; but, being defeated, he and others were, without trial, beheaded at Pontefract, by order of Richard, Duke of Gloucester.

WREN, Sir Christopher, the builder of St. Paul's, &c. &c., was born in 1632, and died in 1723.

WYKEHAM, William de, Bishop of Winchester, and Chancellor in 1367, is memorable as the founder of New College, Oxford, and of Winchester School; he died in 1404.

XENOCRATES, a pupil of Plato, and 25 years teacher in his school; died in 314 B. C., aged 81.

XENOPHON, a Greek commander, who conducted the retreat of the ten thousand, and wrote many works; died nearly 100, in 360 B. C.

XISUTHRUS, the tenth of a dynasty of kings of Chaldea, which was terminated by a flood, from which Xisuthrus was carried in an ark from the sea, towards the head of the rivers, 300 miles, into Armenia. He, his wife, daughter, and the pilot, left the ark first, but then disappeared. Their bewailing friends returned to Sippora, and found writings which Xisuthrus had buried. Priests, and others, saved themselves in the mountains, and returned to Babylonia. There can be little doubt but Xisuthrus was the Noah of the Jews; for the legend contains the same details about sending out birds, &c. Four authors agree in their narratives, besides the account of Moses.

YOUNG, Arthur, a very useful and extensive writer on Agricultural Science, which his labours greatly improved. He died blind in 1820, aged 79.

YOUNG, Edward, D. D., author of Night Thoughts, and three Tragedies; died at Welwyn, in 1765, aged 84.

YOUNG, Dr. Thomas, one of the ablest mathematicians and experimental philosophers. He developed new and perfect views of light, produced a reasonable theory of Egyptian Hieroglyphics, and wrote other able works; he died, aged 59, in 1829.

ZENO, a mystical Greek Philosopher, who flourished at Elia, about 400 B. C.; and there was a later ZENO, a native of Cyprus, and first teacher at Athens, of stoical or self-denying principles.

ZENOBIA, Queen of Palmyra and wife of Odenatus, at whose death, in 267, she declared herself Queen of the East; but Aurelian took Palmyra, and reduced her to a private station.

ZEUXIS, a celebrated Greek painter, in the fourth century, B. C.

ZINGIS-KHAN, or Jenghis-Khan, was born in Tartary, about 1160; about 1200, he was acknowledged chief of the Mogul tribes, for whom he wrote a legal and moral code, divested of religion, of which he tolerated all sects. In 1210, he invaded China, and conquered five provinces. He then defeated the Sultan of Karizm, seized his dominions, and became master of all Central Asia, including Georgia, and the countries around the Caspian. He died in 1227, during a third expedition to China. His posterity still constitute the royal houses in several countries.

ZOROASTER, or ZERDUSHT, a celebrated Chaldean Astronomer and Astrologer, and founder of the Religion of the Magi, who worshipped Fire and the Sun, as emblems of the Deity, and now exist under the name of Parsees.

Among the names which History will record as British Patriots, as well as Princes, that of AUGUSTUS FREDERICK, DUKE OF SUSSEX, will claim a distinguished rank. He was the fifth son of George III., and was born the 27th January, 1773. His Royal Highness at an early age was weaned from the frivolities of a Court Life, and devoted his time to pursuits and studies which qualified him for his useful and benevolent career as a Philanthropic Prince. His Royal Highness died at Kensington Palace, on the 21st April, 1843, and by his will directed that his mortal remains should rest in the Public Cemetery at Kensall-Green, in the vicinity of the Metropolis. The funeral took place on the 4th of May, and was attended by a numerous train of mourners, comprising the most illustrious public characters of the times.

THEOLOGICAL STATISTICS.

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LIST of ARCHBISHOPRICS and BISHOPRICS of the ANGLICAN CHURCH.

Canterbury. — Three-fourths of Kent, peculiars in London, &c. Benefices 343. Churches and Chapels 374. Income £17,000.

York.—Yorkshire, except part of Ripon. Benefices 595. Income £10,000.

London.—Middlesex, Essex, and part of Herts. Benefices 635. Churches and Chapels 689. Income £11,700.

Durham. — Durham, Northumberland, and Hexhamshire. Benefices 199. Churches and Chapels 234. Income £8,000.

Winchester. — Hampshire, with Islands Wight, Guernsey, Jersey, Alderney, and Sark. Surry. Benefices 433. Churches and Chapels 543. Income £10,500.

Bangor.—Benefices 124. Churches and Chapels 192. Income £4,000

Bath & Wells.—Benefices 441. Churches and Chapels 493. Income £5,000.

Carlisle.—Benefices 285. Income £3,000.

Chester.—Churches and Chapels 580. Income £3,250.

Chichester.—Benefices 267. Churches and Chapels 302 Income £4,200.

Ely.—Benefices 495, (being lately increased by 330.) Income £5,500.

Exeter.—Benefices 611. Churches and Chapels 711. Income £2,700.

Gloucester and Bristol.—Benefices 395. Churches and Chapels 492. Income £3,700.

Hereford.—Benefices 256. Churches and Chapels 360. Income £4,200.

Lichfield.—Benefices 606. Churches and Chapels 655. Income £4,500.

Lincoln.—Income £4,000.

Llandaff.—Benefices 192. Churches and Chapels 228. Income £1,000.

Norwich.—Benefices 1,021. Churches and Chapels 1210. Income £4,465

Oxford.—Income £2,400.

Peterborough.—Benefices 290.—Churches and Chapels 338. Income £4,500.

Ripon. — Benefices 153. Churches and Chapels 320. Income £4,500.

Rochester.—Benefices 94. Churches and Chapels 111. Income £1,459.

Salisbury.—Benefices 316. Churches and Chapels 474. Income £5,000.

St. Asaph.—Benefices 156. Churches and Chapels 144. Income £5,300.

St. David's. — Benefices 407. Churches and Chapels 561. Income £2,500.

Worcester.—Churches and Chapels 416. Income £6,500.

Sodor and Man —Benefices 17. Churches and Chapels 28. Income £2,000.

COLLEGIATE CHAPTERS.

Brecon.	Southwell.
Manchester.	Windsor.
Middleham.	Westminster.
St. Katharine's.	Wolverhampton.

Heytesbury.

Revenues of the Established Church, in England and Wales, abridged from the Report of the Commissioners of Ecclesiastical Revenue Inquiry.

	Gross Annual value. £	Average each. £	Net Annual value. £	Average each. £
Archiepiscopal and Episcopal Sees ::	181,631	6727	168,292	5936
Cathedral and Collegiate Churches ::	284,241	—	208,289	—
Separate Revenues of Dignitaries, and other Members of Cathedral and Collegiate Churches :: :: ::	75,854	—	66,465	—
Benefices with and without Cure of Souls, 10,450 :: :: ::	3,197,225	303	3,004,721	285
Total Benefices, *including* those not returned, 10,718 :: :: ::	3,251,159	—	3,055,451	—
Curates employed by *Resident* Incumbents, 1006 :: :: ::	—	—	87,075	86
Ditto by *Non-resident* Incumbents, 4224	—	—	337,620	79
Sinecure Rectories returned, and included as above, 62 :: ::	[illegible]622	300	17,085	275

Benefices with Cure of Souls.

297	under the annual value of	£50
1629	of £50	100
1602	— 100	150
1355	— 150	200
1978	— 200	300
1326	— 300	400
830	— 400	500
506	— 500	600
237	— 600	700
218	— 700	800
126	— 800	900
90	— 900	1000
134	— 1000	1500
32	— 1500	2000
18	— 2000 and upwards.	

Irish Church.

Archbishoprics. Bishoprics.

Armagh.—Income £14.494.
Dublin.—Income £7,786.
Meath.—Income £4 068.
Kildare.—Income £6,278.
Cashel, &c.—Income £5,000.
Cork, &c.
Clogher.—Income £8 668.
Derry.—Income £8,000.
Down.—Income £4,204.
Dromore.—Income £4.216.
Elphin.—Income £6.253
Limerick, &c.—Income £4,973.
Killaloe, &c.
Kilmore.—Income £6,225.
Ossory, &c.—Income £5,730.
Tuam, &c.—Income £6,996.

Scottish Episcopal Church.

Sees.—Edinburgh, Dunkeld, Aberdeen, Ross and Argyle, Brechin, Glasgow.

Bishoprics of the Protestant Episcopal Church in the United States:—

Vermont.	*New Jersey.*	*Kentucky.*
East Diocese.	*Pennsylvania.*	*Ohio.*
Connecticut.	*Maryland.*	*Tennessee.*
New York.	*Virginia.*	*Illinois.*
West York.	*N. Carolina.*	*Missouri.*
	S. Carolina.	*Michigan.*

Colonial Bishops.

Nova Scotia.	*Calcutta.*
Newfoundland.	*Madras & Ceylon.*
Montreal.	*Bombay.*
Toronto.	*Australia, and*
Jamaica.	*A Bishop for the*
Barbadoes.	*Continent.*

Presentation to a Living of the yearly value of £10 and upwards, stamp £20. To any other Benefice, &c. £10. *Bishops on Consecration*, homage-fees £112 10s. 4d., and *Archbishops*, double.

First-fruits, under £40, fees £1 16s. 6d.; above £40, £2 18s.

Colleges and Public Schools.

Eton.	*Repton.*
Westminster.	*Richmond.*
Winchester.	*Manchester.*
Harrow.	*Sherborne.*
Charter-house.	*Shrewsbury.*
St. Paul's.	*Leeds.*
Christ's Hospital.	*Gresham College.*
Merchant Taylors'.	*East India College.*
Bury St. Edmunds.	*Dulwich.*
Reading.	*St. Bees.*
Rugby.	*King's College.*

The *Universities of London* and *Durham*, and *St. David's College*.

There are 400 *Endowed Grammar-schools* in England and Wales.

Members of the Universities of Oxford and Cambridge, in 1839.

Oxford, 5331; of the Convocation, 2684 Cambridge, 5628; of the Senate, 2706.

The following Table indicates the Extent of Property applicable to Charitable Purposes, on which the Enquiries of the Commissioners of Charities are completed.

County.	Income for Education.	Other Charitable Purposes.
	£	£
Bedford	1,841	12,119
Buckingham . .	1,583	9.816
Cornwall	982	2,678
Cumberland . . .	1,930	1,464
Derby	5.381	10,132
Devon	6,578	22,370
Gloucester . . .	5.435	14.072
Hereford	3.529	9,624
Hertford	2,865	9.346
Huntingdon . . .	1,026	2,706
Lancaster . . .	18,715	17,011
Monmouth . . .	1,933	2,950
Norfolk	6,243	30,943
Northumberland .	2,526	3,747
Nottingham . . .	3,029	13.337
Oxford	1,973	12,618
Rutland	1.487	3,296
Salop	6,450	15,086
Somerset	8,413	33,909
Stafford	7,133	13,286
Suffolk	3,991	24,193
Warwick . . .	12,516	29,631
Westmoreland . .	2,261	3 070
Wilts	2,095	14,527
Worcester . . .	7,816	12,540
York	22,210	63,621

Societies and Charitable Institutions, in connexion with the Established Church.

	Established.
Society for Promoting Christian Knowledge	1698
Society for the Propagation of the Gospel in Foreign Parts	1701
National Society for the Education of the Poor	1811
Society for Building and Repairing Churches, &c.	1818
Corporation of the Sons of the Clergy	1678
Corporation for the Conversion of Negroes, &c.	1794
Clergy Orphan Society	1749
Society for the Relief of the Clergy and their Widows	
Anniversary Festival of the Sons of the Clergy	
The Associates of the late Dr. Bray	1698
Patrons of the Anniversary of the Charity Schools	1788
Society for Promoting the Employment of Additional Curates in Populous Towns	1837
Clergy Mutual Assurance Society	1829

Orders in Council,

For fixing the future Annual Payments to be made from certain larger Sees towards the augmentation of the smaller.

Lichfield.—To raise the average annual income of the Bishop to the sum of £4500, there be paid by the Commissioners £850.

Chichester.—To raise the average annual income of the Bishop to £4200, there be paid by the Commissioners £650.

Oxford.—Out of the payments made from the larger Sees, there be paid to the *present* Bishop £750; and that from and after the next avoidance of the See of Oxford, in order to raise the average annual income to £5000, there shall be paid by the Commissioners £3500.

Hereford.—To raise the average annual income of the Bishop to £4200, there be paid by the Commissioners £1400.

Peterborough.—To raise the average annual income of the Bishop to £4200, there be paid by the Commissioners £1400.

Carlisle and Chester.—To raise the average annual income of the Bishops of each of these Sees to £4500, there be paid to the Bishop next succeeding to Carlisle £2000, and to the Bishop next succeeding to Chester £1450.

Lincoln.—To raise the average annual income of the Bishop, for the time being, to £5000, there be paid by the Commissioners to such Bishop £1200; and that, *until* an episcopal house of residence for the Bishop of Lincoln be provided, instead of the House of Buckden, in the County of Huntingdon, now in the diocese of Ely, there be allowed to the present and future Bishops of Lincoln £500 yearly for a residence.

Exeter.—From and after the next avoidance of the See, in order to raise the average annual income to £5000, there be paid by the Commissioners the annual sum of £3400. Also, that the Scilly Islands are in the jurisdiction of the Bishop of Exeter and the Archdeacon of Cornwall, for the time being, respectively.

St. Asaph and Bangor.—When either of the Sees of St. Asaph or Bangor shall become vacant, by death or translation, the Bishop who shall succeed thereto shall take the same as Bishop of St. Asaph and Bangor, the said Bishop to become possessed of all the property, revenues, advowsons, and patronage, then respectively belonging to both the said Sees, and of all the episcopal jurisdiction, power, and authority, then and theretofore exercised by the Bishops thereof. Further proposed, with the view so to leave to the Bishop of St. Asaph and Bangor for the time being, the average annual income of £5200, the Bishop and his successors shall pay out of the revenues of the united Sees to the Ecclesiastical Commissioners of England, the fixed annual sum of £4750.

St. David's.—In order to raise the average annual income of the Bishop to the sum of £4500, there shall be paid by the Commissioners, out of their funds, to the Bishop, who upon the first avoidance of the said See shall succeed thereto, and to his successors, the fixed annual sum of £1600.

Llandaff.—In order to raise the average annual income of the Bishop to the sum of £4200, there shall be paid by the Commissioners upon the first avoidance of the same See to the Bishop who shall succeed thereto, and to his successors, the fixed annual sum of £3150, and a further allowance of £300 a-year until an episcopal residence be provided.

Manchester.—On the union of the Sees of St. Asaph and Bangor taking effect, the collegiate church of Manchester shall forthwith be constituted a cathedral church, and the seat of a Bishop, within the province of York, and the wardens and fellows thereof to be then styled dean and canons. The whole county of Lancaster, excepting the deanery of Furness, to be detached from the diocese of Chester, and to be made and constituted the diocese of the Bishop of Manchester:—the Bishop to be invested with all the same and like rights, privileges, dignities, power, jurisdiction, and authority as are now possessed by the respective Bishops of England and Wales. The said Bishoprick to be endowed with an average annual income of £4500, by the transfer of lands, tithes, or other hereditaments, from some other See or Sees, or partly by such transfer, or partly by a fixed annual payment by the Commissioners from the funds applicable for that purpose.

Stamp Duty on Marriage Certificates.

In answer to some questions recently put to the Chancellor of the Exchequer, upon the subject of certificates of marriage being liable to the stamp duty, it was stated that certified copies of marriage entries obtained from the Registrar, under the provisions of the Registration Act, sect. 36, are *not liable* to the stamp duty of 5*s.*, payable on marriage certificates; and the same exemption applies to certified copies of marriages given by a clergyman under the 35th section.

Registrar-General of Births, Deaths, and Marriages.

According to law, the country is divided into 618 districts, over each of which is appointed a Superintendent-Registrar, and which are generally coincident with the Poor Law Unions. In the latter end of 1838, there were 2193 Registrars employed. Certified copies are transmitted to the General Registrar Office quarterly: they are collected by the Superintendent-Registrars from more than 14,000 persons charged with the duty of compiling them. More than 80,000 separate papers, containing 847,149 entries, have been thus transmitted, of which 739,737 (being all the entries of births and deaths, and such marriages as are registered by the Registrar of Marriages) have been compared with the original by the Superintendent-Registrar, and certified to be correct. The certified copies are examined, arranged, and indexed at the General Registrar Office, and there the abstracts are made which are contained in the Annua Report.

399,712 births were registered—204,863 of males, 194,849 of females. The numbers registered in the first quarter amounted to 74,588, in the second to 89,528, in the third to 113,815, in the fourth 121,781. The registration of births "has, since the com-

mencement, made a considerable and progressive advance; and during the fourth quarter of the first year attained a superiority in point of numbers over the average registration of baptisms," which, it is estimated by the Registrar General, would have amounted to 111,147 quarterly, in 1837-8.

The deaths registered in the year amounted to 335,956, to which must be added 2704 deaths which occurred in the first year, and were registered in the first quarter of the second. This would make 338,660 deaths in the year; while, according to former proportions, the probable number of burials entered in the parochial registers, during the same period, would be 291,715. Mr. Finlayson, in a communication addressed to the Registrar-General, and appended to the Report, estimated the total deaths at home, in the year ending June 30th, 1838, at 335,968.

The per-centage proportion of deaths by small-pox, typhus, and phthisis, was as follows:—

	Males.	Females.
Small-pox	4·262	3·935
Typhus	6·213	6·567
Phthisis	18·152	21·073

2,520 persons died of scarlatina, 3,044 of hooping-cough, 4,732 of measles, and 5,811 of small-pox. The ages of 1,056 persons who died of small-pox are enumerated, and the number under 5 years of age was 867. It is probable, therefore, that the majority of the 5,811 had never been vaccinated, and that about 12,000 die annually by small-pox through the neglect of the parents.

Expenses of Ecclesiastical Establishments in the Colonies, by Grant of Public Money.

Church of England	£212,095
Church of Scotland, &c.	26,112
Church of Rome	16,749

Number of Churches compared with Population :—

Diocese.	Churches.	Population.
Chester	493	2,000,000
London	690	1,690,000
Durham	234	460,000
Lichfield	665	965,000
Winchester	918	995,000
Exeter	714	773,000
Gloucester	492	437,000
Bath and Wells	493	305,000
Salisbury	474	320,000
Chichester	302	231,000

There are in Great Britain about 36 Subscription Societies:—*Ten* are Missionary. The Church Missionary has an income of £72,000; the Baptist, of £22,000; the London, £65,000; the Wesleyan, £85,000; and others, from 4 to £5000 down to 4 or £500. Again, the Christian Knowledge Society has £90,000 income; the Propagation of the Gospel, £71,000; Religious Tract, £62,000; the Pastoral Aid, £10,000; Sunday School Union, £9.000; British and Foreign Bible Society, £105,000; the Hibernian, £12,000; Children's Friend, £6000; the British and Foreign School, £5000. In all, about £640,000 per annum!

MARRIAGES.

The Number of Marriages solemnized in Roman-Catholic Chapels and Protestant Dissenting Places of Worship, in England and Wales, from the 1st of January to the 31st of December, 1838.

In Roman-Catholic Chapels			1629
In Protestant Dissenting Places of Worship of the following denominations, namely:—			
Baptists	605		
Ditto (General)	88		
Ditto (Particular)	28	728	
Ditto (Scotch)	1		
Ditto (Welsh)	6		
Berean Universalists		1	
Bible Christians		1	
Cowardites		1	
Independents	1355	1360	
Ditto (Welsh)	5		
Lady Huntingdon's Connexion		28	
Lutheran Church		2	
Methodists	98		
Ditto (Primitive)	22		
Ditto (New Con.)	39	175	2504
Ditto (Independent)	8		
Ditto (Calvinistic)	7		
Ditto (Episcopal)	1		
New Jerusalem Church		7	
Presbyterians		81	
Relief Church		5	
Secession Church		31	
Southcottians		1	
Swedenborgians		8	
Unitarians		74	
Undefined		1	
Scotland, Church of			45

EDUCATION.

Return to an Order of the House of Commons, in 1835, of the total number of Children educated in England and Wales, by Voluntary Subscription, exhibiting the proportion supported by the Dissenting interest.

	Daily Instruction.	Dissent.
Bedford	6,632	285
Berks	16,574	120
Buckingham	10,834	42
Cambridge	15,269	343
Chester	32,199	1,303
Cornwall	31,629	249
Cumberland	21,531	225
Derby	24,508	334
Devon	54,971	1,076
Dorset	18,158	394
Durham	30,656	550
Essex	32,977	1,235
Gloucester	32,274	1,278
Hereford	8,815	218
Hertford	14,752	433
Huntingdon	5,805	153
Kent	53,721	844
Lancaster	97,534	9,384
Leicester	19,267	283
Lincoln	38,194	413
Middlesex	101,220	9,747
Monmouth	6,645	136
Norfolk	35,128	590
Northampton	18,295	[illegible]

Brought forward	727,518	30,021
Northumberland	24,582	461
Nottingham	21,439	1,134
Oxford	15,939	637
Rutland	2,701	12
Salop	19,179	580
Somerset	35,891	1,260
Southampton	38,733	1,568
Stafford	35,710	2,079
Suffolk	28,642	390
Surrey	45,915	2,146
Sussex	32,877	1,617
Warwick	26,041	1,116
Westmoreland	7,250	795
Wilts	20,375	285
Worcester	17,858	1,000
York.—East Riding	20,406	257
City and Ainsty	4,324	555
North Riding	22,825	387
West Riding	73,932	2,170
Total	1,222,137	48,470

Benefices began about 500. The number in England and Wales are 10,674 benefices, and parochial chapelries, with 649 chapels not parochial, and 227 new churches and chapels, erected under the authority of the church-building acts.

The number of Irish benefices are 2168.

The number of Places of Worship of the Established Church, and those of Dissenters in England, are :—

Of the Established Church of England	11,600
Of Protestant Dissenters	7,634
Of Roman Catholics	388

Church-yards were first consecrated in 317

Councils.—That at Jerusalem, when the first controversy was discussed, in 48
— at Antioch, 269
— at Arles, 314; at which three English bishops were present.
— the first Nicene one, when 328 fathers attended against Arius, 325
— the first at Constantinople, when Pope Damasus presided, and 150 fathers attended, 381
— that at Sardis, when 376 fathers attended, 400
— the first at Ephesus, when Pope Celestine presided, and 200 fathers attended, 431
— the second at Constantinople, when Pope Virgilius presided, and 165 fathers attended, 552
— one called Mileyetan council, 568
— at Constantinople, in 600
— at Rome, in 649
— the third at Constantinople, when Pope Agatho presided, and 289 fathers attended, 680
— the second at Nice, when Pope Adrian presided, and 350 fathers attended, 787
— the fourth at Constantinople, when Pope Adrian and 101 fathers attended, 869
— at Vercellus, when Pope Leo IX. presided, 1053
— the Lateran one, when Pope Innocent II. presided, and 1000 fathers attended, 1139
— the third Lateran one, when Pope Alexander III. presided, and 300 fathers attended, 1175

Council, the fourth Lateran, when Pope Innocent III. presided, and 1185 fathers attended, 1215 and 1217.
— at Lyons, 1255 and 1274.
— that at Vienna, when Pope Clement V. presided, and 300 fathers attended, 1311
— one at Constance, when Pope John XXII. and Martin V. presided, 1414.
— the sixth Lateran one, when Pope Julian III. and Pius IV. presided against Luther, 1546. There have been several other provincial councils, and others, as that of Avignon, in France; and at Bituria, in Tuscany, 1431.
— at Tours in France, 1448.
— at Florence in Italy, 1449.
— at Toledo in Spain, 1437.
— at Aspurgh in Germany, 1548.
— at Cologne in Germany, 1548.
— at Treves in Germany, 1548.
— at Cologne in Germany, 1549.
— at Mentz in Almaine, 1549.
— and at Numantia in Spain, 1550

Numbers professing different Religions.

	Malte-Brun.	*Hassel.*	*Balbi.*
Christianity	228,000,000	252,000,000	260,000,000
Judaism	5,000,000	3,930,000	4,000,000
Mahometanism	110,000,000	120,105,000	96,000,000
Brahmanism	6,000,000	111,353,000	6,000,000
Buddhism	15,000,000	315,977,000	170,000,000
All others	100,000,000	134,490,000	147,000,000
	464,000,000	937,855,000	683,000,000

Another estimate is :—

Protestant	85,500,000
Catholics	175,600,000
Mahometans	102,300,000
Pagans	397,800,000
Brahmins	81,500,000
Jews	6,300,000
	849,000,000

Religious Orders, Sects, &c.

Albigenses had their origin in	1160
Anabaptists, began	1525
Antinomian sect	1538
Arian sect	320
Armenian	1568
Augustines	390
Capuchins	1528
Cardinals	853

Carmelites 1141
Carthusians 1084
Dominicans 1215
Dissenters from the Church of England, first appeared in Queen Elizabeth's reign .. ..
Franciscans 1206
Grey Friars 1122
Hugonots 1560
Hutchinsonians 1730
Independents 1580
Jesuans 1367
Kirk of Scotland 1561
Lollards 1315
Lutherans 1517
Methodism 1734
Monks first associated 828
Moravians appeared in Bohemia .. 1457
Protestants 1529
Puritans 1545
Quakers 1650
Trappists, order of monks, solemnly installed at Port Bingeard, department of Mayenne, Jan. 21, 1815
Trinitarians 1198
Unitarians 1553
Ursulines established 1198

The principal superstitions and impostors put forward by the authorities of the ancient world, are comprised in the following list:—

An acquaintance with the motions of the heavenly bodies, and the variations in the state of the atmosphere, enabled its possessor to predict astronomical and meteorological phenomena, with a frequency and an accuracy which could not fail to invest him with a divine character.

The power of bringing down fire from the heavens, even at times when the electric influence was itself in a state of repose, could be regarded only as a gift from heaven.

Dreams, and spectral appearances, in all their forms and varieties.

The science of acoustics furnished the ancient sorcerers with some of their best deceptions.

The imitation of thunder, in their subterranean temples, could not fail to indicate the presence of a supernatural agent.

The golden virgins, whose voices resounded through the temple of Delphos.

The stone from the river Pactolus, whose trumpet-notes scared the robber from the treasure which it guarded.

The speaking head, which uttered its oracular responses, at Lesbos.

The vocal statue of Memnon, which began at the break of day to accost the rising sun.

The marvellous fountain which Pliny describes, in the island of Andros, as discharging wine for seven days, and water during the rest of the year.

The spring of oil, which broke out in Rome, to welcome the return of Augustus from the Sicilian war.

The glass tomb of Belus, which was full of oil, and which, when once emptied, by Xerxes, could not again be filled.

The weeping statues and the perpetual lamps of the ancients; the rapid descent of those who consulted the oracle in the cave of Trophonius;—these were all deceptions, derived from science, and from a diligent observation of the phenomena of nature.

INQUISITION IN SPAIN.

Table of the Number of Victims under forty-five Inquisitors-General, between 1481 *and* 1808.

Between		Burnt alive.	Burnt in effigy.	Condemned to the Gallies, or to imprisonment.
1481 & 1498.	Under the Inquisitor-Generalship of Torquemada	10,220	681	97,371
1498 — 1507.	Under that of Deza	2,592	8[illegible]9	32,[illegible]52
1507 — 1517.	Under that of Cardinal de Ximenes ..	3,564	2,232	48,059
1517 — 1521.	Under that of Adrian de Florencio ..	1,620	560	21,835
1521 — 1523.	(An Interregnum)	324	112	4,481
1532 — 1538.	Under the Inquisitor-Generalship of Manrique	2,250	1,125	11,250
1533 — 1545.	Under that of Tabera	840	420	6,520
1546 — 1556.	Under that of Loaisa, and during the reign of the Emperor Charles V. ..	1,320	660	6,600
1556 — 1597.	During the reign of Philip II.	3,990	1,845	18,450
1597 — 1621.	During that of Philip III.	1,840	692	10,716
1621 — 1665	During that of Philip IV.	2,852	1,428	14,080
1665 — 1700.	During that of Charles II.	1,632	540	6,512
1700 — 1746.	During that of Philip V.	1,600	760	9,120
1746 — 1759.	During that of Ferdinand VI.	10	5	170
1759 — 1788.	During that of Charles III.	4	0	56
1788 — 1808.	During that of Charles IV.	0	1	42
		34,658	18,049	288,214

The Cotton Trade, owing to monetary disturbances, has undergone great fluctuation in England and other countries. In the nine months to Michaelmas, 1839, only 979,329 bales were imported and consumed in Great Britain; but, in the same nine months of 1838, the bales were 1,297,125, a decrease of a fourth.

In *Yarn*, the exports were, in 1839, 72,695,784lbs., against 85,231,989lbs. in 1838. In plain calicoes, in 1839, the exports were increased 2,710 yds., and dyed, 24,622,388.

The general trade of France rose, in 1838, to 1,893,000,000 francs; or, 327,000,000 more than in 1837, and 30,000,000 more than in 1836. The increase in exports was, on cottons and woollens, nearly 40,000,000.

The French imports, in 1838, were 937 millions, and the exports 956 millions. The United States trade was 16 per cent on the whole amount, and that of England 12 per cent.

On the 27th of January, 1846, Sir R. Peel brought forward his proposal for a most important alteration in the Corn Laws and the Tariff. He announced his intention to reduce immediately to a nominal amount the existing duties on the importation of corn, grain, meal, and flour, and their total repeal on the 1st of February 1849. The receipt of these duties for the year ending the 5th of January, 1846, amounted to £357,203. He also proposed to reduce the duties on a great variety of articles imported from foreign countries, and which duties in the last annual return amounted to £2,326,105, and likewise the total repeal of another class of articles, yielding a return of £55,879, making altogether a reduction in the finances of the year, of £2,739,187. These important legislative measures for the encouragement of free trade, and the supply of cheap food, were obstinately resisted by a strong party in both houses of parliament, and postponed the third reading of the bill in the House of Commons, from the 15th of February until the 15th of May, when it was carried by a majority of 98. In the House of Lords these important measures were carried, after a violent opposition without a division, on the 25th of June.

The annual fall of meteors, in August and November, continue to astonish all students of nature. On the night of the 10th of August, 1839, there fell at *Breslau*, before 3 in the morning, 1008 meteors—5 the size of Venus, 14 of Jupiter, and 238 equal to stars of the first magnitude. South, at Kensington, saw, between 9 and midnight, 165 shooting stars; clouds then intervened. No rational theory on the subject has yet been propagated.

Among the small number of really new discoveries in science, in 1839, may be placed that of M. Daguerre, of Paris, who has succeeded in analyzing the phenomena of nitrate of silver, when exposed to solar light. Instead of presenting an unformed dark mass, he arranges and fixes its forms, and produces a *regular* representation of external objects. Since the first announcement, some other very ingenious improvements have been made, and the subject is pregnant with interest. Mr. Talbot has varied the French discovery, and the philosophers of Europe are seizing on the whole as a key to further illustrations of the principle of light itself.

The discovery of Schoenbein, of Basle, of the curious property of iron to resist the action of nitric acid (its most energetic solvent), has been seized upon by Mr. Hawkins of Brighton, by whom, after a prolonged series of experiments, the principle has been applied in the adoption of iron as a *substitute* for platina, with all the energy of this metal, in voltaic batteries; thereby advancing the prospects of voltaic electricity. With a battery of six cells only, constructed of iron plates in nitric acid, separated from amalgamated zinc-plates in dilute sulphuric acid, by vessels of porous ware, the brilliant light from charcoal points, ignition of 6 inches of platina wire, and great magnetic power are exhibited for several hours without abatement of energy. One cell proves equal to the decomposition of water—which, indeed, depending as it does upon intensity, is effected by a single circle, consisting of a fine iron-wire, and a bit of zinc no larger than a sixpence.

An important discovery in science has been made by Professor Faraday; who has ascertained that a ray of light may be electrified and magnetized, and that lines of magnetic force may be rendered luminous.

Commercial transactions have been much affected by the stoppage of the United States Bank, and the simultaneous stoppage to pay in specie by many other American Banks. It merits emphatic notice, however, that there is an equivoque in the word stoppage. The American Banks are Banks of State currency, while English Banks are raised on private deposits on cash. A State and a Bank are established at the same time by a law, and the Bank implies no possession of specie, only a State credit to create a limited amount of local circulation in paper. It deals in coin as far as convenient, but no longer, and as its notes are secured by lands, &c., so the stoppage to pay in cash is altogether different from an English Bank, though the mere fact leads to mistakes.

Anthracite coal, of which South Wales contains 6000 millions of tons, is at length found to be manageable by Player's Patent Furnace. This coal contains no bitumen, and gives out no gas or smoke; but, it requires a uniform temperature to prevent decrepitation and exploding. It, also, permits the use of no poker, and will then smother for hours with intense heat. For generating steam, &c., it is invaluable.

New Postage Law of Dec. 1839.—The weight which a letter may pass through the Penny Post-Office is *half an ounce*, or 218¾ grains.—A half-crown, of 1817, weighs about 208 grains, of which 7000 are pound avoirdupois.—An ordinary sheet of small post 4to. writing-paper weighs about 120 grains, and

large thick post 180 grains.—Small thin post, such as is used in France, &c., is about 65 grains.—The ordinary quantity of wax upon a letter weighs 6 grains.—20 dips of ordinary ink, from a steel pen, weigh about 4 grains; but, when dry, they only weigh 1 grain.—A drop of water weighs about 1 grain.

POST-OFFICE.—The gross revenue of this establishment for the year ending 5th Jan., 1844, was £1,535,215 8s. 4½d. The cost of management was £980,650 7s. 5¾d.—leaving the sum of £554,565 0s. 10¾d. net.

Messrs. Wheatstone and Co. have made successful attempts to establish a *rapid* magnetic correspondence, by the Western Railway, between London and Bristol.

ELECTRIC TELEGRAPH.—That recently erected at the South Western Railway, besides being used as a telegraph for the railway, will, it is understood, be the official mode of communication between the Admiralty Office, at London, and the Naval Establishment, at Portsmouth, and also will be at the command of the public in general, on the payment of a small fee. By this telegraph, the entire report of a railway meeting has been communicated from Portsmouth to London, a distance of 70 miles, in less than half an hour. There are also electric telegraphs on most of the principal railroads.

In 1845, Mount Hecla, in Iceland, ejected two streams of burning lava, which was thrown to the distance of 23 miles. Two miles from the crater, the lava was a mile in width, and fifty feet in depth. Eruptions have continued occasionally since.

On the 29th August, 1842, was signed a Treaty of Perpetual Peace and Friendship between Great Britain and China, and the ratifications thereof, under the respective seals and signs manual of the Queen of Great Britain and the Emperor of China, were duly exchanged at Hong Kong, on the 26th June, 1843. By this treaty the Chinese engaged to pay to her Britannic Majesty the sum of twelve millions of dollars towards the expenses of the war.

Hungerford Suspension Bridge, across the Thames, from Hungerford Market to Lambeth, was opened in 1845. It is constructed for foot passengers only, at a toll of a half-penny. The cost of this bridge was 80,000*l.*

In 1844, the memorable trial of Daniel O'Connell, M.P., and others, for conspiring against the government, was commenced at Dublin, on the 15th of January, and continued to the 24th February, when a verdict of *guilty* was returned. On the 20th of May, the following sentence was pronounced: "Daniel O'Connell, M.P., to be imprisoned twelve calendar months, fined £2,000, and be bound to keep the peace for seven years, himself in the sum of £5,000, and two sureties in the sum of £2,500 each. The others to nine months' imprisonment, a fine of £50, bound in their own recognizance of £1,000, and two sureties of £500 each, to keep the peace for the same term of ten years." The prisoners appealed to the House of Lords, against the legality of the trial and verdict, on the ground of an illegal jury. Their Lordships allowed the objections, reversing the judgment of the Court of Queen's Bench in Ireland, and on the 6th of September, Mr. O'Connell and his fellow-prisoners were triumphantly liberated.

On the 28th October, 1844, the New Royal Exchange, erected on the site of that built in the reign of Queen Elizabeth, accidentally destroyed by fire, in 1838, was opened with great ceremony, in the presence of Her Majesty Queen Victoria.

The Earl of Ross has constructed a telescope, which has an aperture of six feet, and a focal length of fifty-two feet. The speculum weighs three tons. By the use of this stupendous telescope Nebulæ have been resolved into thousands of distinct stars.

The celebrated collection of pictures in needle-work, by the late Miss Linwood, which have formed one of the most interesting and surprising public exhibitions in London, during half a century, was sold by auction on the 23rd of April, 1846.

The quantity of light gold coin paid into the Bank of England, between June, 1842, and February, 1844, amounted to 2,779 ozs., the value of which, at the rate of £3 17s 10½d per oz., was £10,820,731 5s., the whole of which was delivered to the Mint for re-coinage. In the same period, the Bank received from the Mint new gold coin, amounting in value to the sum of £9,730,975. The whole amount of light gold paid into the Bank since the proclamation in 1842, to 1844, was £11,137,224; the loss on which was estimated at from £1 to £1 5s. per cent.

From official documents presented to parliament, it appears that the tax imposed on income and property produced, in the year ending 5th January, 1846, the amount of £5,306,458 15s. 5d.

Duty on glass was abolished in 1845.

During the space of one year, ending the 30th of June, 1845, there were exported from China to the United Kingdom of Great Britain and Ireland, in one hundred and six ships, 539,59,666 lbs. of tea.

In 1845, acts were passed for the construction of new railways to the extent of 2,747 miles, at an estimated expense of about £43,500,000. The subject of railways has since become the most important object of parliamentary and governmental enquiry.

In 1814 there was but one steam-boat belonging to the British empire. During 30 years the number has increased to 1000 British steam-boats, which are now navigating to and from all parts of the world.

The largest bell ever cast in England was completed in 1846, by Messrs. Mears of Whitechapel, for the Catholic cathedral at Montreal. It weighs 7 tons, 11 cwt. 2 qrs. 12 lbs., being 32 cwt. heavier than Great Tom of Lincoln, and required 10 tons of fused metal to form the cast.

In 1842 the Artesian Well of Grenoble at Paris was completed; the depth is 1,794½ feet, or nearly nine times the height of the Monument in London.

ALPHABETICAL INDEX.

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